

AMERICAN SOCIETY OF ANTHROPOLOGY

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For members of the Society

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AMERICAN SOCIETY OF ZOÖLOGISTS

Officers for 1933

President.....	CHARLES ZELENY
Vice-President.....	J. H. BODINE
Secretary.....	WILLIAM H. COLE
Treasurer.....	ALDEN B. DAWSON

Executive Committee

(In addition to the four officers)

CASWELL GRAVE.....	to serve until December, 1933
C. B. DAVENPORT.....	to serve until December, 1934
H. V. NEAL.....	to serve until December, 1935
FERNANDUS PAYNE.....	to serve until December, 1936
W. C. CURTIS.....	to serve until December, 1937

Representative of the Society in the Division of Biology and Agriculture of the National Research Council

To serve until July 1, 1935.....	J. H. BODINE
	A. M. BANTA, Alternate

Representatives of the Society on the Council of the American Association for the Advancement of Science

W. H. LONGLEY	G. A. BAITSELL
---------------	----------------

Representatives of the Society on the Council of the Union of American Biological Societies

G. T. HARGITT	A. F. SHULL
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Representatives of the Society on the Advisory Editorial Board of "Biological Abstracts"

H. S. PRATT AND G. K. NOBLE.....	Taxonomy
D. H. TENNENT.....	General Embryology
M. H. JACOBS.....	General Physiology

Managing Editor of the Journal of Morphology

To serve until December, 1936.....	C. E. McCLUNG
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Members of Editorial Board of the Journal of Morphology

To serve until December, 1933

L. V. HEILBRUNN	S. O. MAST	G. K. NOBLE
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To serve until December, 1934

D. E. MINNICH	B. H. WILLIER	L. L. WOODRUFF
---------------	---------------	----------------

To serve until December, 1935

L. R. CLEVELAND	F. L. HISAW	FRANZ SCHRADER
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AMERICAN SOCIETY OF ZOÖLOGISTS

CONSTITUTION

ARTICLE I

NAME AND OBJECT

Section 1. The Society shall be called the "American Society of Zoölogists."

Sec. 2. The object of the Society shall be the association of workers in the field of zoölogy for the presentation and discussion of new or important facts and problems in that science and for the adoption of such measures as shall tend to the advancement of zoölogical science.

ARTICLE II

MEMBERSHIP

Section 1. The membership of the Society shall consist of two classes:

a. Associate membership open to all actively engaged in the field of zoölogy who have had training in zoölogy equivalent to that required for the doctorate degree.

b. Active membership open to those who hold the doctor's degree in zoölogy or who have done work equivalent thereto, and who, in addition to the usual requirements for this degree, have published the results of substantial zoölogical research.

Sec. 2. Election to membership in the Society shall be upon recommendation of the Executive Committee.

Sec. 3. Associate members shall not hold office or vote, but may present papers before the Society without introduction. Associate members shall receive all literature issued by the Society, including the proceedings of the Society, and shall have the same privileges as active members in journal subscriptions.

Sec. 4. Associate members may be elected to active membership in the usual way when the research requirements of active membership have been met.

ARTICLE III

OFFICERS

Section 1. The officers of the Society shall be a President, a Vice-President, a Secretary, a Treasurer, and the members at large of the Executive Committee.

Sec. 2. The Executive Committee shall consist of the President, the Vice-President, the Secretary, the Treasurer, and five members elected from the Society at large. Of these five members, one shall be elected each year to serve five years. If any member at large shall be elected to any other office, a member at large shall be elected at once to serve the remainder of his term.

Sec. 3. These officers shall be elected by ballot at the annual meeting of the Society and their official terms shall commence with the close of the annual meeting, except that the Secretary and the Treasurer shall be elected triennially and shall serve for three years.

Sec. 4. The officers named in Section 1 shall discharge the duties usually assigned to their respective offices. (See by-laws.)

Sec. 5. Vacancies in the board of officers, occurring from any cause, may be filled by election by ballot at any meeting of the Society. A vacancy in either the Secretaryship or the Treasurership occurring in the interval of the meetings of the Society may be filled, until the next annual meeting, by appointment by the Executive Committee.

Sec. 6. At the annual meeting the President shall name a nominating committee consisting of three active members. It shall be the duty of this committee to nominate officers of the Society, including the permanent representatives which the Society is asked to name to various boards and councils. This committee shall make its nominations to the Secretary at least four months before the next annual meeting. Additional nominations for any office may be made in writing to the Secretary by any five members at any time previous to balloting.

ARTICLE IV

MEETINGS OF THE SOCIETY

Section 1. Unless previously determined by the Society, the time and place of the annual meeting shall be determined by the Executive Committee. Special meetings may be called and arranged for by the Executive Committee. Notices of such meetings shall be mailed to all members of the Society at least two weeks before the date set for the meeting.

Sec. 2. Sections of the Society may be organized in any locality by not less than ten members, for the purpose of holding meetings for the presentation of scientific papers. Such sections shall have the right to elect their own officers and also associate members; provided, however, that associate membership in any section shall not confer membership in the Society.

ARTICLE V

QUORUM

Twenty-five members shall constitute a quorum of the Society and four a quorum of the Executive Committee.

ARTICLE VI

CHANGES IN THE CONSTITUTION

Amendments to this Constitution may be adopted at any meeting of the Society upon approval of two-thirds of the members voting, subject to the following conditions:

a. The proposed amendment must be in writing and signed by at least five members of the Society.

b. This signed proposal must be in the hands of the Secretary at least one month before the meeting of the Society at which it is to be considered.

c. The Secretary shall mail copies of the proposed amendment to the members of the Society at least two weeks before the meeting.

d. Members unable to attend may submit their votes in writing to the Secretary.

BY-LAWS

ARTICLE I

DUES

The annual dues for active and associate members, unless remitted or changed by the vote of the Society, shall be two dollars.

ARTICLE II

PRESIDENT

Section 1. The President shall preside at scientific sessions and at the business meetings.

Sec. 2. He shall also appoint the committees prescribed by the constitution and by-laws.

ARTICLE III

VICE-PRESIDENT

Section 1. The Vice-President shall preside at sessions designated by the President.

Sec. 2. He shall also assume the duties of the President in the latter's absence.

ARTICLE IV

SECRETARY

Section 1. The Secretary shall keep the records of the Society.

Sec. 2. He shall be responsible for all arrangements for the meetings, including the appointment of local committees.

Sec. 3. Whenever the proper officers of a number of related societies shall have a conference covering matters of mutual interest to the several societies, he shall act as the delegate or representative of this Society.

Sec. 4. He shall make such purchases and employ such assistance as will, in his judgment, expedite the business of the Society, and

Sec. 5. He shall be reimbursed out of the funds of the Society for expenses incurred in attending meetings of the Society.

ARTICLE V

TREASURER

Section 1. The Treasurer shall be in charge of the funds of the Society.

Sec. 2. At the annual business meeting of the Society he shall present a statement to date of the funds of the Society.

Sec. 3. He shall make such purchases and employ such assistance as will, in his judgment, expedite the business of the Society.

ARTICLE VI

AUDITING COMMITTEE

The President shall annually appoint an auditing committee of two, who shall audit and report upon the financial record and statement of the Treasurer at the meeting for which they were appointed.

ARTICLE VII

PROGRAM RULES

In matters relating to programs for annual meetings, the following rules shall be observed:

Section 1. Titles and abstracts of papers to be presented by any method at the annual meeting must be sent to the Secretary in duplicate before the final date set by him. The length, form, and arrangement of the abstracts must comply with the requests of the Secretary in order to insure prompt publication by The Wistar Institute. The titles and abstracts of papers which do not conform to such requests or papers which are received late may be presented by title only.

Sec. 2. Titles shall be listed in groups according to subject matter, the groups to be determined by the Secretary.

Sec. 3. Whenever conditions require, the Secretary shall schedule two or more groups for the same hour and arrange the program to bring together papers on subjects of more general interest for meetings of the whole Society.

Sec. 4. Each member may have not more than fifteen minutes of the time of the Society at the annual meeting. This time may be used by him to present one or more papers personally or to introduce papers of non-members.

Sec. 5. All papers not read when called for as listed shall be placed at the end of the group list, and if not read when called for the second time, shall be read by title only.

Sec. 6. The titles of 'introduced' papers may be listed in the groups after the titles of papers to be read by members.

LIST OF FORMER OFFICERS

AMERICAN MORPHOLOGICAL SOCIETY

<i>President</i>	<i>Vice-President</i>	<i>Secretary-Treasurer</i>
1890—E. B. Wilson		J. P. McMurrich
1891—C. O. Whitman	E. L. Mark	J. P. McMurrich
1892—C. O. Whitman	H. F. Osborn	J. P. McMurrich
1893—C. O. Whitman	E. B. Wilson	J. P. McMurrich
1894—C. O. Whitman	W. B. Scott	G. H. Parker
1895—E. B. Wilson	W. B. Scott	G. H. Parker
1896—E. L. Mark	H. F. Osborn	G. H. Parker
1897—C. S. Minot	S. I. Smith	G. H. Parker
1898—H. F. Osborn	T. H. Morgan	G. H. Parker
1899—E. G. Conklin	W. M. Wheeler	Bashford Dean
1900—T. H. Morgan	H. C. Bumpus	J. S. Kingsley
1901—J. S. Kingsley	E. A. Andrews	T. H. Montgomery
1902—H. C. Bumpus	G. H. Parker	M. M. Metcalf

Additional Members of the Executive Committee

1891—E. B. Wilson	1897—J. S. Kingsley
H. F. Osborn	Bashford Dean
1892—E. L. Mark	1898—C. B. Davenport
T. H. Morgan	F. R. Lillie
1893—T. H. Morgan	1899—J. P. McMurrich
C. B. Davenport	G. H. Parker
1894—E. A. Andrews	1900—F. R. Lillie
F. H. Herrick	Jacob Reighard
1895—T. H. Morgan	1901—C. F. W. McClure
S. Watase	C. W. Hargitt
1896—E. G. Conklin	1902—H. S. Jennings
William Patten	R. G. Harrison

AMERICAN SOCIETY OF ZOOLOGISTS

<i>EASTERN BRANCH</i>	<i>President</i>	<i>CENTRAL BRANCH</i>
G. H. Parker	1903	Jacob Reighard
E. A. Andrews	1904	C. H. Eigenmann
W. E. Castle	1905	F. R. Lillie
W. E. Castle	1906	C. C. Nutting
C. B. Davenport	1907	S. A. Forbes
W. M. Wheeler	1908	E. A. Birge
H. S. Jennings	1909	E. A. Birge
T. H. Montgomery	1910	C. E. McClung
H. V. Wilson	1911	George Lefevre
A. G. Mayer	1912	H. B. Ward
Raymond Pearl	1913	H. B. Ward

LIST OF FORMER OFFICERS

EASTERN BRANCH

Jacob Reighard
W. E. Castle
William Patten
William Patten
F. H. Herrick
H. S. Jennings
H. V. Wilson
H. H. Wilder
H. E. Crampton
G. A. Drew
Alex. Petrunkevitch

Vice-President

1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913

CENTRAL BRANCH

H. F. Nachtrieb
S. J. Holmes
William A. Locy
George Lefevre
H. B. Ward
M. F. Guyer
M. F. Guyer
H. F. Nachtrieb
R. H. Walcott
C. M. Child
C. M. Child

Secretary-Treasurer

G. A. Drew
G. A. Drew
H. S. Pratt
H. S. Pratt
C. J. Herrick
L. L. Woodruff
L. L. Woodruff
H. W. Rand
Raymond Pearl
J. H. Gerould
Caswell Grave

1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913

Frank Smith
F. R. Lillie
C. E. McClung
T. G. Lee
T. G. Lee
T. G. Lee
Charles Zeleny
H. V. Neal
H. V. Neal
W. C. Curtis
W. C. Curtis

Executive Committeemen

F. R. Lillie
T. H. Montgomery
H. C. Bumpus
H. S. Jennings
E. A. Andrews
W. R. Coe
G. A. Drew
M. M. Metcalf
D. H. Tennent
R. G. Harrison
H. E. Jordan
C. E. McClung

George Lefevre
T. G. Lee
Herbert Osborn
C. H. Eigenmann
J. G. Needham
S. J. Holmes
W. A. Locy
C. M. Child
R. H. Walcott
W. C. Curtis
Oscar Riddle
H. B. Ward
Chauncey Juday
H. W. Norris
C. E. McClung
H. F. Nachtrieb

AMERICAN SOCIETY OF ZOÖLOGISTS (AMALGAMATED)

	<i>President</i>	<i>Vice-President</i>	<i>Executive Committeemen</i>
1914.	C. E. McClung	M. F. Guyer	H. E. Jordan—1 year H. F. Nachtrieb—2 years H. V. Wilson—3 years George Lefevre—4 years A. F. Shull—5 years
1915.	W. A. Loey	W. E. Ritter	D. H. Tennent—5 years
1916.	D. H. Tennent	Charles Zeleny	R. P. Bigelow—5 years L. J. Cole—4 years
1917.	M. M. Metcalf	Charles Zeleny	H. V. Wilson—5 years
1918.	George Lefevre	L. L. Woodruff	M. M. Metcalf—5 years
1919.	C. M. Child	H. H. Wilder	George Lefevre—5 years
1920.	Gilman A. Drew	Caswell Grave	C. M. Child—5 years
1921.	Charles A. Kofoid	Aaron T. Treadwell	G. A. Drew—5 years
1922.	H. H. Wilder	Bennet M. Allen	C. A. Kofoid—5 years
1923.	M. F. Guyer	Robert A. Budington	H. H. Wilder—5 years
1924.	R. G. Harrison	R. K. Nabours	J. H. Gerould—1 year
1925.	C. R. Stockard	C. R. Moore	M. F. Guyer—5 years
1926.	S. O. Mast	W. C. Allee	R. G. Harrison—5 years
1927.	S. J. Holmes	Robert Chambers, Jr.	C. R. Stockard—5 years
1928.	Caswell Grave	M. H. Jacobs	S. O. Mast—5 years
1929.	C. B. Davenport	Fernandus Payne	S. J. Holmes—5 years
1930.	H. V. Neal	E. E. Just	
1931.	Fernandus Payne	D. E. Minnich	
1932.	W. C. Curtis	L. V. Heilbrunn	

Secretary-Treasurer

1914-1918. Caswell Grave
1918-1921. W. C. Allee

Secretary

1921-1924. W. C. Allee
1925-1928. D. E. Minnich
1928-1929. L. B. Arey
1929-1930. D. E. Minnich

Treasurer

1922. D. H. Tennent
1923-1924. R. H. Bowen
1925-1930. L. B. Arey

*Representative in the Division of Biology and Agriculture,
National Research Council*

M. F. Guyer 1919-1921	G. H. Parker 1919-1922	F. R. Lillie 1919-1923
William Patten 1921-1924	H. S. Jennings 1922-1925	E. G. Conklin 1923-1926
J. T. Patterson 1924-1927	L. L. Woodruff 1925-1928	H. S. Jennings 1929-1931
G. H. Parker 1926-1929	E. G. Conklin 1926-1929	L. C. Dunn 1931-1932

Associate Editors of the Journal of Morphology

1921. Gary N Calkins	J. S. Kingsley	William Patten
1921-1922. E. G. Conklin	M. F. Guyer	W. M. Wheeler
1921-1923. C. A. Kofoid	F. R. Lillie	J. T. Patterson
1923-1924. G. A. Drew	H. V. Neal	L. L. Woodruff
1923-1925. Caswell Grave	D. H. Tennent	H. V. Wilson
1924-1926. Helen Dean King	S. O. Mast	A. A. Schaeffer
1925-1927. R. W. Hegner	Fernandus Payne	H. B. Ward
1926-1928. L. J. Cole	J. H. Gerould	M. H. Jacobs
1927-1929. W. C. Curtis	J. Percy Moore	A. F. Shull
1928-1930. Edgar Allen	G. A. Baitsell	R. E. Coker
1929-1931. S. R. Detwiler	R. S. Lillie	H. J. Muller
1930-1932. W. R. Coe	E. N. Harvey	H. E. Jordan

LIST OF PLACES OF MEETING

AMERICAN MORPHOLOGICAL SOCIETY

1890—Boston	1894—Baltimore	1899—New Haven
1891—Philadelphia	1895—Philadelphia	1900—Baltimore
1892—Princeton	1896—Boston	1901—Chicago
1893—New Haven	1897—Ithaca	1902—Washington
	1898—New York	

CENTRAL NATURALISTS

1899—Chicago	1900—Chicago
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SOCIETY OF AMERICAN ZOÖLOGISTS

1901—Chicago	1902—Washington
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AMERICAN SOCIETY OF ZOÖLOGISTS

EASTERN BRANCH	JOINT MEETINGS	CENTRAL BRANCH
1903—Philadelphia	1905—Ann Arbor	1903—St. Louis
1904—Philadelphia	1908—Baltimore	1905—(Mch.) Chicago
1906—New York	1911—Princeton	1907—(Mch.) Madison
1907—New Haven	1912—Cleveland	1907—Chicago
1909—Boston	1913—Philadelphia	1910—(Apr.) Iowa City
1910—Ithaca		1910—Minneapolis
		1912—(Apr.) Urbana
MEETING PLACES		
1914—Philadelphia	1920—Chicago	1926—Philadelphia
1915—Columbus	1921—Toronto	1927—Nashville
1916—New York	1922—Boston	1928—New York
1917—Minneapolis	1923—Cincinnati	1929—Des Moines
1918—Baltimore	1924—Washington	1930—Cleveland
1919—St. Louis	1925—New Haven	1931—New Orleans
		1932—Atlantic City

PROGRAM FOR THE THIRTY-FIRST ANNUAL
MEETING OF THE AMERICAN SOCIETY
OF ZOÖLOGISTS

HARVARD UNIVERSITY, CAMBRIDGE, MASSACHUSETTS
DECEMBER 28, 29, 30, 1933

As features of the meeting, a symposium on the development and growth of the nervous system on Thursday afternoon and an all-day program at the new Institute of Biology at Harvard, have been arranged. The usual joint session with the Naturalists will be held Saturday afternoon. Sessions for the reading of papers will therefore be limited to Thursday and Saturday mornings. Simultaneous sections in different fields of zoölogy have been scheduled, and, as far as practicable, papers have been grouped together according to subject matter. Obviously it is impossible to classify all papers satisfactorily to all members because of the overlapping of subjects. It is hoped, however, that the arrangements will be acceptable to a large majority.

On Friday morning the Physiological and the Zoölogical Laboratories of the Institute will be open for inspection. Demonstrations of equipment and of research in progress will be presented by members of the Harvard Staff. Directions and a list of the demonstrations will be furnished on Thursday. The committee in charge of this exhibit consists of W. J. Crozier and L. Hoadley. At noon the business meeting of Section F is scheduled, to be followed by the business meeting of the Society.

Friday afternoon will be devoted to the demonstrations presented by members of the Society according to the program. This period will also make time available for informal individual and group conferences, and for further inspection of the laboratories.

The annual dinner for all zoölogists and friends will be held Friday evening at the Hotel Statler, Boston, at which the vice-president of Section F, Dr. A. S. Pearse, will speak on 'Ecological Segregation.' Members are urged to make their reservations early so as to relieve the pressure on the local committee at the last minute.

In the preliminary announcement of the meeting sent out in September, the Nominating Committee's report was published. Since then another nominee for Secretary has been selected because of the withdrawal of D. H. Wenrich. The Committee recommends H. B. Goodrich as their nominee.

The following titles and abstracts were received on or before November 10th by the Secretary of the Society, and have been arranged according to the program rules.

The abstracts are in the form contributed by their authors. They have been edited only to secure a uniform system of titles and style and to reduce length when necessary. Their arrangement and the planning of the program can be done only after the titles are all at hand and must be greatly rushed in order to obtain publication before the meetings. The Wistar Institute is scheduled to mail out this issue of *The Anatomical Record* 3 weeks after receiving the manuscript. All proofreading will be done there. The Institute deserves great credit for making possible the early publication and distribution of this material.

These abstracts and the accompanying data are presented as a part of the official proceedings of the 1933 meetings of the Society. The minutes of the meetings, a list of the officers of the Society for 1934, and a list of members will appear in the January number of this journal.

An alphabetical author index of all persons contributing to the program will be found on pages 109 to 112.

PROGRAM

THURSDAY, DECEMBER 28TH

- 10.00 A.M. *Sect. a.* Endocrinology. Papers 1 to 11, inclusive. Nash Lecture Room, first floor, Botanical Museum. (Entrance: center door, Oxford St.)
- Sect. b.* Physiology. Papers 19 to 31, inclusive. Geology Lecture Room, first floor, Geological Section, University Museum. (Entrance: south door, Oxford St., or rear door, Divinity Ave.)
- Sect. c.* Morphology and Embryology. Papers 81 to 86 and 99 to 103, inclusive. Museum of Comparative Zoölogy, Room 101. (Entrance: north door, Oxford St., or rear door, Divinity Ave.)
- 2.00 P.M. Symposium on "Development and Growth of the Nervous System," led by S. R. Detwiler. Geology Lecture Room, first floor, Geological Section, University Museum. (Entrance: south door, Oxford St., or rear door, Divinity Ave.)
1. "Factors influencing the development and segmentation of spinal ganglia."—S. R. Detwiler.
 2. "The origin and development of cranial ganglia based upon experimental studies in amphibia."—Leon S. Stone.
 3. "The effects of the peripheral fields upon spinal cord development."—Victor Hamburger.
 4. "The growth of the spinal cord and ganglia in relation to the functional development of the hind leg in *Amblystoma*."—George E. Coghill.
- 9.00 P.M. Biologists' Smoker. Georgian Room, Hotel Statler, Boston.

FRIDAY, DECEMBER 29TH

- 10.00 A.M. Inspection of Zoölogical and Physiological Laboratories in the new Biological Laboratories on Divinity Ave. Demonstrations of equipment and of research in progress by members of the Harvard Staff. Directions and a list of demonstrations will be available on Thursday.
- 12.00 A.M. Business meeting of Section F. Geology Lecture Room, first floor, Geological Section, University Museum. (Entrance: south door, Oxford St., or from Divinity Ave.)
- 12.10 P.M. Business meeting of American Society of Zoölogists. Same as for Section F above.

FRIDAY, DECEMBER 29TH—*Continued*

- 2.00 P.M. Demonstrations by members of Society. Papers 21 and 22; 45 to 48; 87 and 88; 104 to 106; 126 to 129; 167; 175 to 177, inclusive. Biological Laboratories, Divinity Ave., Rooms B 150-160; B 248-254; 348-354.
- 6.30 P.M. Zoölogists' Dinner. Address by Vice-President of Section F, A. S. Pearse, on 'Ecological Segregation.' Hotel Statler, Boston.

SATURDAY, DECEMBER 30TH

- 10.00 A.M. *Sect. a.* Histology and Cytology; Protozoölogy, Parasitology. Papers 120 to 125; 145 to 148; 156 and 157, inclusive. Nash Lecture Room, first floor, Botanical Museum, University Museum. (Entrance: center door, Oxford St.)
- Sect. b.* Physiology. Papers 32 to 44. Geology Lecture Room, first floor, Geological Section, University Museum. (Entrance: south door, Oxford St., or rear door, Divinity Ave.)
- Sect. c.* Miscellaneous. Papers 165 to 174, inclusive. Museum of Comparative Zoölogy, Room 101. (Entrance: north door, Oxford St., or rear door, Divinity Ave.)
- 2.00 P.M. Joint session with American Naturalists, Botanists and Geneticists. Symposium on 'Biology and Society.' New Lecture Hall, corner Oxford and Kirkland Sts.

SPECIAL NOTICE. The Biological Department at Wellesley College has extended a cordial invitation to all biologists to inspect the new laboratories some time Friday or Saturday. Details of the trip will be announced at the meetings, and those planning to go are asked to make their reservations early.

LIST OF TITLES

ENDOCRINOLOGY

Read

1. Observations on transplanted immature ovaries in the eyes of adult male and female rats. Leroy Goodman, Harvard Medical School. (Introduced by George B. Wislocki.) (Lantern; 15 min.)
2. Changes in the skin of the albino rat at sexual maturity, and following injections of pregnancy urine. Earl O. Butcher, Hamilton College. (Lantern; 7 min.)
3. Light in relation to the sexual cycle and to hibernation in the thirteen-lined ground squirrel. G. E. Johnson and E. L. Gann, Kansas State College. (Lantern; 5 min.)
4. Permanent and cyclical sex characters in finches. W. N. Keck and Emil Witschi, State University of Iowa. (Lantern; 15 min.)
5. Compensatory hyper-activity of the testis following unilateral castration. George K. Smelser, Columbia University. (Introduced by H. H. Newman.) (12 min.)
6. The nocturnal occurrence of oestrus in the female guinea pig. Edward W. Dempsey, William C. Young, Hugh I. Myers and David B. Jennison, Brown University. (Lantern; 15 min.)
7. The gross action of prolactin and gonad-stimulating hormone on the mature ovary of the fowl. Robert W. Bates, Ernest L. Lahr and Oscar Riddle, Carnegie Institution of Washington. (Lantern; 10 min.)
8. Relation of adrenal cortical function to certain aspects of resistance. Ernest W. Blanchard, Bryn Mawr College. (Introduced by D. H. Tennent.) (Lantern; 10 min.)
9. The effect of daily hetero-pituitary implants into adult but sexually inactive male ground squirrels. G. E. Johnson and E. L. Gann, Kansas State College. (Lantern; 10 min.)
10. Induction of egg-laying in the Spanish newt, *Pleurodeles waltl*. Helen M. Hilsman, University of Pittsburgh. (Introduced by H. H. Collins.) (Lantern; 7 min.)
11. Thyroxine concentration and the metamorphic pattern in *Anura*. William Etkin, University of Chicago. (Introduced by Carl R. Moore.) (Lantern; 12 min.)

By title

12. A hitherto unnamed factor of the hypophysis of the infantile rat. Olive Swezy, University of California.
13. Transplantation of the adult hypophysis into salamander larvae. Robert K. Burns, Jr., University of Rochester.

14. Histological effects of potassium iodide and thyroid substance on the thyroid gland of the guinea pig in experimental scurvy. W. Fulton Abercrombie, New York University. (Introduced by Daniel Ludwig.)
15. Sexual conditions in *Triturus viridescens*. Artificial hermaphroditism with pituitary treatment. (Male hosts with ovarian grafts.) A. E. Adams and Josephine Dudley, Mount Holyoke College.
16. Changes in adrenals of newts following hypophysectomy or thyroidectomy. A. E. Adams and Elizabeth M. Boyd, Mount Holyoke College.
17. Studies on the femoral pad of *Triturus viridescens*. C. M. Pomerat, Harvard University. (Introduced by A. B. Dawson.)
18. The question of sex specificity and the prevention of castrate cells in the anterior pituitary. Philip V. Rogers, Hamilton College. (Introduced by Earl O. Butcher.)

PHYSIOLOGY

Read

19. Nutrition of *Melanoplus differentialis* Thomas (Orthoptera: Acrididae) on a diet of boiled wheat leaves, alone and supplemented with accessory food-stuffs. Charles Hodge, IV, Temple University (Introduced by P. P. Calvert.) (Charts; 10 min.)
20. The interrelations of different technics and criteria for the measurement of the growth of yeast. Oscar W. Richards, Yale University. (Lantern; 12 min.)
21. Reduction of islets in the pancreas of fish by means of diet, lack of exercise, and overeating. Walter N. Hess, Hamilton College. (Lantern; 10 min.) (Also by demonstration.)
22. Regeneration of the islets in the pancreas of fish. Walter N. Hess, Hamilton College. (Lantern; 5 min.) (Also by demonstration.)
23. Combinations of current and antecedent conditions affecting the production of wings in aphids. A. Franklin Shull, University of Michigan. (Lantern; 15 min.)
24. The effect of homotypic conditioning of water on the growth of fishes and chemical studies of the factors involved. W. C. Allee, E. S. Bowen, J. C. Welty and R. Oesting, University of Chicago. (Lantern; 15 min.)
25. Sodium chloride cytolysis in the sea urchin egg. D. Mazia, University of Pennsylvania. (Introduced by L. V. Heilbrunn.) (5 min.)
26. Electrokinetic studies of marine ova. Katsuma Dan. (Introduced by L. V. Heilbrunn.) (Lantern; 5 min.)
27. The effect of mechanical stimulation on the protoplasmic viscosity of amoeba. C. A. Angerer, University of Pennsylvania. (Introduced by L. V. Heilbrunn.) (5 min.)
28. Changes in the oxidation-reduction potential and pH of bacteria-free cultures of *Chilomonas*. Theo. L. Jahn, Yale University. (Lantern; 10 min.)
29. The effect of oxygen tension on oxygen consumption of a developing egg (Orthoptera.) Joseph Hall Bodine, State University of Iowa. (Lantern; 10 min.)
30. The circulation of blood in the frog's kidneys in relation to the anuria produced by asphyxia. Edward F. Adolph, University of Rochester. (Lantern; 10 min.)

31. Mammalian relationships by the precipitin test. Harold R. Wolfe, University of Wisconsin. (Introduced by Alan A. Boyden.) (Lantern; 15 min.)
32. Effects of freezing in liquid air on the excised heart of turtles. E. Alfred Wolf and Richard A. Torgesen, University of Pittsburgh. (Lantern; 10 min.)
33. Effects of environmental conditions on longevity. Lester Ingle, Brown University. (Introduced by A. M. Banta.) (Lantern; charts; 15 min.)
34. Further studies on the longevity and swimming ability of spermatozoa. B. H. Grave, De Pauw University. (Lantern; 10 min.)
35. The effect of ethyl urethane on bacterial respiration and luminescence and on the Cypridina luminescent reaction in vitro. G. Welford Taylor, Princeton University. (Introduced by E. N. Harvey.) (Lantern; 7 min.)
36. The light intensity of luminous bacteria as a function of oxygen pressure. Herbert Shapiro, Princeton University. (Introduced by E. N. Harvey.) (Lantern; 7 min.)
37. Some effects of x-ray irradiation on developing grasshopper eggs. Titus Carr Evans, State University of Iowa. (Introduced by J. H. Bodine.) (Lantern; 5 min.)
38. Reactions of *Drosophila* to 2537Å radiation. Frank E. Lutz, American Museum of Natural History, and E. N. Grisewood, New York University. (10 min.)
39. The relation of yellow coat color to the incidence of spontaneous mammary tumors in mice. C. C. Little, Roscoe B. Jackson Memorial Laboratory. (Lantern; 15 min.)
40. The distribution of pressure in the human foot. Herbert Elftman, Columbia University. (Introduced by Secretary of Section F.) (Motion pictures; 15 min.)
41. The effect of barbiturates in normal and nephropathic mammals. Theodore Koppanyi and W. S. Murphy, Georgetown University. (Lantern; 5 min.)
42. The effects of barbiturates in the fowl. W. S. Murphy and T. Koppanyi, Georgetown University. (Lantern; 5 min.)
43. Comparative pharmacology. Theodore Koppanyi, Georgetown University. (Lantern; 5 min.)
44. A new method for counting red cells. Eric Ponder, Albert S. Gordon and Max Dubin, New York University. (Introduced by Robert Chambers.) (Lantern; 10 min.)

By demonstration

45. Sexual conditions in *Triturus viridescens*. Artificial hermaphroditism. (Male hosts with ovarian grafts.) A. E. Adams, Mount Holyoke College.
46. Transformation of dermal plicae into tympanic membrane. O. M. Helff, New York University.
47. Action potentials in the nervous system of the crayfish. C. Ladd Prosser, Harvard Medical School.
48. The respiratory function of hemoglobin in certain embryos. F. G. Hall, Duke University.

By title

49. Growth in *Daphnia pulex*. B. G. Anderson and L. J. Zupancic, Jr., Western Reserve University.
50. Determination of brood size in *Moina macrocopa*. L. A. Brown, Transylvania College, and A. M. Banta, Brown University.
51. Observations on the overwintering of adult beetles. Ann H. Morgan and Janet F. Wilder, Mount Holyoke College.
52. Results of further efforts to end dormancy period of *Daphnia longispina* sexual eggs. Thelma R. Wood, Brown University and Carnegie Institution of Washington.
53. Studies on the weight-area relationships of fishes. H. C. Burdick, State University of Iowa. (Introduced by J. H. Bodine.)
54. The effects of temperature on the viscosity of *Arbacia* egg protoplasm. Donald P. Costello, University of Pennsylvania. (Introduced by L. V. Heilbrunn.)
55. The osmotic behavior of red cells. Eric Ponder and E. J. Robinson, New York University. (Introduced by Robert Chambers.)
56. A method for following osmotically induced volume changes in muscle. Arthur K. Parpart, Princeton University. (Introduced by E. N. Harvey.)
57. Specific dynamic effect of food on flux equilibrium of cell oxidation and E.M.F. E. J. Lund, University of Texas.
58. An electrometric study of permeability of the grasshopper egg membrane (*Melanoplus differentialis*). A. B. Taylor and Edgar John Boell, State University of Iowa. (Introduced by J. H. Bodine.)
59. Studies of the electromotive force of biological systems. III. The influence of lack of oxygen upon recovery of potential in frog skin. Edgar John Boell and A. B. Taylor, State University of Iowa. (Introduced by J. H. Bodine.)
60. The flattening of marine eggs under the influence of gravity. E. N. Harvey, Princeton University.
61. The tensile strength of a developing egg (Orthoptera). Margarita Williams, State University of Iowa. (Introduced by J. H. Bodine.)
62. Studies on the respiration of fishes. H. C. Burdick, State University of Iowa. (Introduced by J. H. Bodine.)
63. Iron content and oxygen consumption rates in developing embryos (Orthoptera.) Joseph Hall Bodine and Julius E. Wolkin, State University of Iowa.
64. Some effects of carbon dioxide on the developing grasshopper embryo (*Melanoplus differentialis*). Louisa M. Bradway, State University of Iowa. (Introduced by J. H. Bodine.)
65. Changes in the pH of the blood of the Japanese beetle (*Popillia japonica* Newman) during metamorphosis. Daniel Ludwig, New York University.
66. The relation of integrity of the cell to bacterial luminescence. Irvin M. Korr, Princeton University. (Introduced by E. N. Harvey.)
67. The effect of copper on amoeba protoplasm. C. A. Angerer, University of Pennsylvania. (Introduced by L. V. Heilbrunn.)
68. The significance of Ca to marine fishes on invading fresh water. C. M. Breder, Jr., New York Aquarium.
69. H-ion concentration as a factor in the toxicity of Amines. Ruth B. Howland and Alan Bernstein, New York University and Johns Hopkins University.

70. Stimulation in *Fundulus* by hydrochloric, sulfuric, and nitric acids and by the corresponding sodium salts in sea water. James B. Allison and William H. Cole, Rutgers University.
71. Stimulation by the dicarboxylic acids in fresh and salt water in *Fundulus heteroclitus*. Irwin W. Sizer, Rutgers University. (Introduced by William H. Cole.)
72. The frequency and amplitude of locomotor waves of blow-fly larvae as related to light intensity and temperature. John H. Welsh, Harvard University.
73. Factors influencing the spawning of *Ostrea gigas*. C. R. Elsey, Pacific Biological Station. (Introduced by T. C. Nelson.)
74. Evidence for a sympathetic innervation of the teleost heart. Floyd J. Brinley, North Dakota State College.
75. Recovery of non-developing mud wasp larvae after irradiation with x-rays. J. H. Bodine and T. C. Evans, State University of Iowa.
76. X-irradiation of the ovaries of guinea pigs and its effect on subsequent pregnancies. Ida T. Genther, Children's Hospital Research Foundation and University of Cincinnati.
77. Inhibition of regeneration in the adult newt by x-irradiation. Pressley L. Crummy, University of Pittsburgh. (Introduced by H. H. Collins.)
78. The mechanism of tandem behavior following the colonizing flight in termites. Alfred E. Emerson, University of Chicago.
79. Experimental modification of the seasonal sexual cycle of the English sparrow, *Passer domesticus*. Arthur Kirschbaum, University of Minnesota. (Introduced by A. R. Ringoen.)
80. On the genesis of oral incubation in fishes. C. M. Breder, Jr., New York Aquarium.

MORPHOLOGY

Read

81. Polydactylism in mice. J. M. Murray, R. B. Jackson Memorial Laboratory. (Introduced by C. V. Green.) (10 min.)
82. The mechanism of differentiation of chelae in some crustacea. Hugh H. Darby, Bartol Research Foundation. (Introduced by J. H. McGregor.) (Lantern; 15 min.)
83. Fluctuations in the composition and structure of bone and their bearing upon endochondral ossification. Samuel E. Pond, Marine Biological Laboratory, Woods Hole. (Introduced by W. H. Cole.) (Lantern; 12 min.)
84. Analysis of the regenerative processes in Nemertean. W. R. Coe, Yale University. (Lantern; 12 min.)
85. The effects of x-rays on anterior regeneration in *Lumbriculus inconstans*. Clarence D. Turner, University of Georgia. (Introduced by J. W. Nuttycombe.) (5 min.)
86. Influence of sulphydryl and sulfoxide on chromosome and aster dimensions in regenerating tissues of *Clymenella torquata*. Frederick S. Hammett, Marine Experimental Station of Lankenau Hospital Research Institute. (10 min.)

By demonstration

87. Presence of tyrosinase in the skin of the newt, *Triturus viridescens*. Kenneth L. Kelley, University of Pittsburgh. (Introduced by H. H. Collins.)
88. Regeneration in *Thyone briareus* L. following induced evisceration. Frank R. Kille, University of Chicago. (Introduced by B. H. Willier.)

By title

89. Further observations on supernumerary structures induced in planarians by cautery. E. D. Goldsmith, Harvard University. (Introduced by H. W. Rand.)
90. Variations in the human hyoid bone. H. H. Collins and D. L. Platt, University of Pittsburgh.
91. Diffraction spectra produced by striated muscle: Fresh and intact, and fixed and sectioned. Alexander Sandow and Benjamin P. Sonneblick, New York University. (Introduced by Robert Chambers.)
92. Bilateral and unilateral development of ovaries in raptorial birds. F. L. Fitzpatrick, Columbia University. (Introduced by Secretary of Section F.)
93. The hypophysis cerebri of the bat, *Myotis lucifugus lucifugus*. Mary J. Guthrie, University of Missouri.
94. Integumentary regeneration and mitogenetic rays. O. M. Helff, New York University.
95. Effect of Ringer's solution on tail regeneration in the tadpole of *Rana palustris*. Leonard P. Sayles, College of the City of New York. (Introduced by William H. Cole.)
96. Reconstitution of anuran tail integument over wound areas. F. W. Dunihue, New York University. (Introduced by O. M. Helff.)
97. The formation of nerve endings in the suckers of regenerated arms of the Cephalopod, *Octopus vulgaris* Lam. Raoul M. May, Collège de France and Institut Pasteur.
98. A regenerative gradient in partially histolyzed anuran tail skin. F. W. Dunihue, New York University. (Introduced by O. M. Helff.)

EMBRYOLOGY

Read

99. The development of fragments of the fertilized Triton egg containing the second polar spindle but no spermatozoon. G. Fankhauser, Princeton University. (Lantern; 15 min.)
100. The capacity for differentiation of regions of the unincubated chick blastoderm. Elizabeth Butler, Universities of Chicago and Rochester. (Introduced by B. H. Willier.) (Lantern; 15 min.)
101. Reaction of chick embryos to mechanical shock. Theodore C. Byerly and M. W. Olsen, Bureau of Animal Industry. (Lantern; 5 min.)
102. Reaction of chick embryos to different environmental temperatures. Theodore C. Byerly and M. W. Olsen, Bureau of Animal Industry. (Lantern; 5 min.)
103. Regeneration of the tail fins of *Fundulus* embryos. James H. Birnie, Brown University. (Introduced by H. E. Walter.) (Lantern; 15 min.)

By demonstration

104. The egg of *Sabellaria vulgaris* V. and its fertilization reaction. A. J. Waterman, Brooklyn College.
105. Demonstrations on gonadal development in birds. Emil Witschi, State University of Iowa.
106. Development of the hair follicle and hair in vitro. Margaret R. Murray, Columbia University.

By title

107. Primordial germ cells in a 4.5-mm. human embryo. G. W. D. Hamlett, Harvard Medical School.
108. Fertilization membranes of *Asterias* eggs centrifuged before fertilization. Donald P. Costello, University of Pennsylvania. (Introduced by L. V. Heilbrunn.)
109. Prelocalization of organ-forming substances in the early embryo of *Drosophila melanogaster*. Ruth B. Howland and George P. Child, New York University.
110. Potencies of the mesectoderm of early chick blastoderms. Thomas E. Hunt, University of Alabama.
111. The origin of the tubuli efferentia and epididymal tubules in the domestic fowl. J. C. Gray, Western Reserve University.
112. Nutritive processes in the embryos of the Goodeidae, viviparous top minnows of Mexico. C. L. Turner, Northwestern University.
113. The spermatogenetic and seasonal cycle of the testis of the musk turtle, *Sternotherus odoratus* (Latreille). Paul L. Risley, State University of Iowa. (Introduced by E. Witschi.)
114. The ability of the immature ovary to function in the adult castrated rat. Carroll A. Pfeiffer, State University of Iowa. (Introduced by Emil Witschi.)
115. Further studies of exogastrulation in the sea urchin. A. J. Waterman, Brooklyn College.
116. Survival of rat fetuses following electro-cautery of the brain. E. L. Corey, University of Virginia.
117. Heteroplastic transplantations of *Rana sylvatica* tail bud to *Amblystoma punctatum*. E. D. Goldsmith, Harvard University. (Introduced by H. W. Rand.)
118. Transplantation of chick metanephric tissue to the chorioallantoic membrane of the duck. Carl J. Sandstrom, New York University.
119. Behavior of larval grafts upon adult *Triturus viridescens*. W. H. Wright and H. H. Collins, University of Pittsburgh.

HISTOLOGY AND CYTOLOGY

Read

120. The origin and nature of the nucleolus. Mary S. Gardiner, Bryn Mawr College. (10 min.)
121. The membranous labyrinth of the dogfish. R. E. Bowen, Long Island University. (Introduced by Secretary of Section F.) (Lantern; 10 min.)

122. Pseudopodia and flowing movements in living germ cells. W. J. Baumgartner, University of Kansas. (Lantern; 10 min.)
123. The ovarian cycle in *Triturus viridescens*. Helen M. Hilsman, University of Pittsburgh. (Introduced by H. H. Collins.) (Lantern; 8 min.)
124. Follicular atresia in the bat, *Myotis lucifugus lucifugus*. Katharine R. Jeffers and Mary J. Guthrie, University of Missouri. (Charts; 10 min.)
125. The pituitary gland, ovaries, and reproductive tract of the bat, *Myotis lucifugus lucifugus*. Mary J. Guthrie, Katharine R. Jeffers and Elizabeth L. Sawyer, University of Missouri. (Lantern; 15 min.)

By demonstration

126. Cytology of hypermastigote flagellates. L. R. Cleveland, S. R. Hall, Elizabeth P. Sanders and Jane Collier, Harvard University.
127. Maturation and cleavage in fertilized and unfertilized grasshopper eggs. E. H. Slifer and R. L. King, State University of Iowa.
128. The sex chromosome mechanism and sex determination in *Sciara*. C. W. Metz, Carnegie Institution and Johns Hopkins University.
129. The effects of some fixing reagents upon the sensory endings of the ear of the dogfish. R. E. Bowen, Long Island University. (Introduced by Secretary of Section F.)

By title

130. The histology of the malpighian tubules of *Melanoplus differentialis*. Richard R. Stuart, State University of Iowa. (Introduced by H. W. Beams.)
131. Histological changes in a prolapsed intestine of a fish, *Mollienisia latipinna* Le Sueur. R. F. Nigrelli and C. M. Breder, Jr., New York University and New York Aquarium.
132. A suggestion as to the origin of oriented smooth-muscle strata in the wall of a tube. Frederic T. Lewis, Harvard Medical School.
133. Origin of melanophores in *Platyopocilus*. Roy Tasker, Cornell University. (Introduced by Secretary of Section F.)
134. Absence of Rouget cells on the blood capillaries of *Nereis virens*. H. W. Beams, R. R. Stuart and J. E. McCroan, State University of Iowa.
135. Notes on the cytology of endochondral bone formation in *Mus norvegicus albinus*. Frances Louise Smith, State University of Iowa. (Introduced by H. W. Beams.)
136. Germ cell origin and spermatogenesis in the Siamese fighting fish, *Betta splendens*. Neville L. Bennington, Northwestern University. (Introduced by C. L. Turner.)
137. Germ cell origin and gonad differentiation in the viviparous top minnow, *Lebistes reticulatus*. Glenn C. Dildine, Northwestern University. (Introduced by C. L. Turner.)
138. The chromosomes during the spermatogenesis of two species of *Xiphophorus*, of *Platyopocilus maculatus* and of *Xiphophorus-Platyopocilus* hybrids. E. M. Ralston, Northwestern University. (Introduced by C. L. Turner.)
139. Chromosomes of two species of *Gryllidae*: *Orthoptera*. R. L. King and H. W. Beams, State University of Iowa.

140. Somatic synapsis in *Chironomus*. R. L. King and H. W. Beams, University of Iowa.
141. A method for the qualitative analysis of the chromosomes of *Drosophila melanogaster*. T. S. Painter, University of Texas.
142. Effects of centrifugal force on the ectoplasmic layer, nuclei and cleavage of fertilized sea urchin eggs. Ethel Browne Harvey, Princeton University.
143. Polyovular follicles in the ovary of a young cat. Pauline H. Dederer, Connecticut College.
144. The effect of temperature on osmicated fats and Golgi apparatus in liver cells of fish. Ross C. McCordle, Brown University and Temple University. (Introduced by Secretary of the Society.)

PROTOZOÖLOGY

Read

145. *Diffugia cratera* Leidy, a ciliate. Stephen R. Williams, Miami University. (Lantern; 7 min.)
146. Fermentation of carbohydrates by *Colpidium*, and effects of carbohydrates on growth. Alfred M. Elliott, New York University. (Introduced by R. P. Hall.) (Lantern; 10 min.)
147. The fate of differentiated organelles in the division process of devescovid flagellates. Harold Kirby, University of California. (Lantern; 10 min.)
148. The relation of the nucleus to amoeboid movement in *Amoeba dubia*. Robert Chambers, New York University. (5 min.)

By title

149. Host-parasite specificity in the genus *Balantidium*. Robert Hegner, Johns Hopkins University.
150. Ciliates from Bermuda sea urchins. Miriam Scott Lucas, Washington University.
151. The trophic nature of *Chlorogonium* and *Chilomonas*. John B. Loefer, New York University. (Introduced by R. P. Hall.)
152. Growth of *Colpidium campylum* with reference to oxygen relationships. R. P. Hall, New York University.
153. Effects of salts of certain fatty acids on growth of *Chilomonas* and *Chlorogonium*. John B. Loefer, New York University. (Introduced by R. P. Hall.)
154. Effects of certain organic acids and protein derivatives on the growth of *Colpidium*. Alfred M. Elliott, New York University. (Introduced by R. P. Hall.)
155. Bacteria-free cultures of *Astasia* spp.; the structure and taxonomic position of *Astasia ocellata* (= *Euglena quartana*?). Theo. L. Jahn, Yale University.

PARASITOLOGY

Read

156. Frogs and their opalinid commensals. Maynard M. Metcalf. (15 min.)
 157. Some studies on North American larval trematodes. E. L. Miller, Louisiana State University. (Introduced by William H. Gates.) (10 min.)

By demonstration

158. A new parasitic cirripede (*Crinoidoxenos halocypris*). Charles H. Blake, Massachusetts Institute of Technology.

By title

159. New trematodes from Louisiana reptiles. H. J. Bennett, Louisiana State University. (Introduced by William H. Gates.)
 160. Observations on the trematode fauna of deep-sea fishes of Tortugas, Florida. Harold W. Manter, University of Nebraska.
 161. *Gyrodactylus* as a parasite of the tadpoles of *Rana catesbeiana*. H. W. Stunkard and F. W. Dunihue, New York University.
 162. Further studies on trypanosomiasis in the canary. Reginald D. Manwell, Syracuse University.
 163. Further observations on the life-cycle of *Cercariaeum lintoni*. H. W. Stunkard, New York University.
 164. A temperature reaction in a cold-blooded animal. C. T. Hurst and C. R. Walker, Western State College of Colorado.

MISCELLANEOUS

Read

165. Natural history of the four-toed salamander, *Hemidactylium scutatum* (Schlegel). Frank N. Blanchard, University of Michigan. (Lantern; 15 min.)
 166. Spade-foot toads (*Scaphiopus holbrookii*) in Connecticut in 1933. S. C. Ball, Yale University. (Lantern; 12 min.)
 167. Heredity of immune reactions in rabbits. Clyde E. Keeler and W. E. Castle, Harvard University. (Lantern; 15 min.) (Also by demonstration.)
 168. The phylogeny of the Cirripedia (barnacles). Charles H. Blake, Massachusetts Institute of Technology. (5 min.)
 169. Longevity and maximum growth are incompatible. C. M. McCay and Mary F. Crowell, Cornell University. (Introduced by H. D. Reed.) (Lantern; 10 min.)
 170. Experimental demonstration of internal resistance and population cycles. Royal N. Chapman, University of Hawaii. (Lantern; 15 min.)
 171. The causes of certain diseases in salmonoid fishes and their cure. H. P. Kjerschow Agersborg, State of New Hampshire Department of Fisheries and Game. (15 min.)

172. Social reconstruction by human sterilization. J. H. Landman, College of the City of New York. (Introduced by Secretary of Section F.) (15 min.)
173. WITHDRAWN.
174. The guarantee of evolution in nature. Henry J. Reynolds, Chicago. (Introduced by the Secretary of Section F.) (15 min.)

By demonstration

175. Temperature reactions and skin structures in a northern toad, *Bufo americanus*, and a southern toad, *Bufo valliceps*. Ann H. Morgan and Virginia F. Babcock, Mount Holyoke College.
176. A rapid haematoxylin technique for routine use. Elbert C. Cole, Williams College.
177. Motion pictures of normal and cancerous cells in tissue culture. Robert Chambers, New York University.

By title

178. Selective intra vitam staining of specific elements in the integument of the squid. Elbert C. Cole, Williams College.
179. The ripening of haematoxylin. Elbert C. Cole, Williams College.
180. Comparative study of the blood cells of caudate amphibia. R. M. Haff, Cornell University. (Introduced by Secretary of Section F.)
181. Study of the postembryonic growth of a hereditary melanotic neoplasm in hybrids between two fish species. H. D. Reed, Myron Gordon and Winifred Lansing, Cornell University.
182. The biotic constants of *Tribolium confusum* Duval. Royal N. Chapman and Lillian Baird, University of Hawaii.
183. Evolutionary trends in the large-winged mites. Arthur Paul Jacot, Cornell University. (Introduced by Secretary of Section F.)
184. The food of *Rana catesbeiana*. S. W. Frost, Pennsylvania State College. (Introduced by A. H. Wright.)

ABSTRACTS

An author index for all abstracts will be found on pages 109 to 112.

ENDOCRINOLOGY

Read

1. OBSERVATIONS ON TRANSPLANTED IMMATURE OVARIES IN THE EYES OF ADULT MALE AND FEMALE RATS. LeRoy Goodman, Harvard Medical School. (Introduced by George B. Wislocki.) (Lantern; 15 min.)

Ovaries of 21-day-old white rats were placed in the anterior chamber of the right eye of twenty normal adult female and twenty adult male rats. A series of twenty spayed females received similar transplants. The twenty males were castrated 2 months post-transplantation.

The percentage of takes, i.e., those transplants showing follicles or corpora lutea or both, as well as those showing no follicles but reacting to anterior lobe or prolan, was highest in the spayed females, lowest in the non-spayed females, and intermediate in the males, the latter differing little whether castrated or not. In contrast to the females, the males never showed corpora lutea unless given anterior lobe. Immature ovaries were hastened in their development in all successful implants. Vaginal cycles were exhibited in a large percentage of the spayed females, in some instances, however, without the appearance of corpora lutea in the grafts. Although complete correlation between the cyclical changes in the vagina and the appearance of the graft was difficult to determine, nevertheless all spayed females exhibiting cycles manifested pronounced follicular or luteal growth changes in the transplants.

2. CHANGES IN THE SKIN OF THE ALBINO RAT AT SEXUAL MATURITY, AND FOLLOWING INJECTIONS OF PREGNANCY URINE. Earl O. Butcher, Hamilton College. (Lantern; 7 min.)

A study of the skin from the dorsum of the immature rat shows that the hair follicles continue to increase in size and length, and that the subcutaneous layer gradually becomes more fatty up to 40 to 45 days. At the time of sexual maturity, there occurs a decrease in the fatty content of the subcutaneous layer, a great shortening of the follicle, and shedding of the hair.

If 30- to 35-day rats are given subcutaneously 3 cc. of pregnancy urine or 25 R.U. of Antuitrin S daily for 6 days, growth of the hair follicle and fatty deposition are inhibited and the skin resembles the condition found at sexual maturity. If the injections are not begun until the rats are 40 to 45 days old, that is, after the hair follicle has reached the maximum length, similar skin changes to those at sexual maturity appear within 6 days.

Exactly how pregnancy urine induces this effect has not been determined at this time. Experimental female animals gained as much weight as controls which were given normal urine, while experimental males gained less.

3. LIGHT IN RELATION TO THE SEXUAL CYCLE AND TO HIBERNATION IN THE THIRTEEN-LINED GROUND SQUIRREL. G. E. Johnson and E. L. Gann, Kansas State College. (Lantern; 5 min.)

Groups of six male and six female ground squirrels, sexually inactive, were placed respectively in red, green, white, blue and ultraviolet light from 5 P.M. to 12 P.M. daily from December 1 to July 1. A control group of twelve animals was kept in the dark at night. In the day all the animals were in daylight, slightly dimmer than in ordinary rooms. Most of the males showed genital enlargement from January to May and the females from February to May, but only small differences between control and 'light' groups could be detected.

Groups of three males and three females were placed respectively under continuous red light, continuous white light and in the dark, all in the cold room, from December 28th to March 23rd. Each animal was in hibernation most of the time to March 9th, when the room temperature rose. On March 9th two males and one female (two in the control group) in each group showed some genital enlargement. On March 23rd marked genital enlargement was seen in two males and one female (two in the control group) from each group. The third male showed somewhat more genital enlargement in the 'light' groups than in the 'dark' group. Cages and lights were now transferred to a dimly lighted warm room. All three groups showed sexual development there. Light, therefore, showed little effect on hibernation or on the sexual cycle.

4. PERMANENT AND CYCLICAL SEX CHARACTERS IN FINCHES. W. N. Keck and Emil Witschi, State University of Iowa. (Lantern; 15 min.)

Two types of finches are considered in these studies. In both the gonads show yearly cycles, enlarging enormously toward the breeding season and at the same time increasing their output in sex hormones. If kept in laboratory rooms well exposed to the normal daylight, the English sparrow comes into its activity phase in spring, while, on the contrary, several species of African weavers reach the peak late in the fall. The endocrine changes in the females are indicated most clearly by corresponding variations in the size of the oviduct. In the male sparrows and several male weavers the bill assumes a perfectly black color during the height of the breeding season. In some weavers the bill instead becomes a bright red. The plumage of weaver finches outside the breeding season is alike in both sexes. During the breeding season the males develop a very colorful plumage and some feathers grow rapidly and assume peculiar shapes. In the English sparrow, quite to the contrary, the plumage dimorphism is independent of sex hormones. Not only does the male retain its more strikingly patterned plumage throughout the year but the dimorphic features are also maintained (and regenerated) by both sexes after castration and even when supplied with the hormones of the opposite sex.

5. COMPENSATORY HYPER-ACTIVITY OF THE TESTIS FOLLOWING UNILATERAL CASTRATION. George K. Smelser, Columbia University. (Introduced by H. H. Newman.) (12 min.)

A truly compensatory hypertrophy of the ovary following unilateral ovariectomy has been recognized for many years. No similar hypertrophy of the testis has been reported, though this subject has been investigated by many authors, nor has a satisfactory explanation of this difference been offered.

Since this hypertrophy is essentially due to an increase in the number of maturing germ cells it was thought that unilateral castration might affect the sperm production of the remaining testis. A satisfactory method was devised for estimating the number of sperm present in an epididymis and a group of twenty-three adult rats were unilaterally castrated. The number of sperm contained in the tail of the epididymis was determined and after periods varying from 14 to 68 days the animals were sacrificed and the number of sperm in the remaining epididymis counted. A series of control experiments showed that the number of sperm contained in the right and left epididymes was the same.

The data obtained in these experiments indicate that the sperm production of a testis doubles after unilateral castration. In all of these experiments there was no compensatory enlargement of the testis. In the production of ova each ovum is associated with a relatively immense structure, the graafian follicle; it is these attendant follicles whose mass increases the ovarian weight and causes the compensatory hypertrophy reported in cases of unilateral ovariectomy. This fact accounts for the difference in reaction of the two sex glands to unilateral gonadectomy. The fundamental basis for the compensatory hypertrophy of the ovary and the compensatory hyperplasia of the testis is the same.

6. THE NOCTURNAL OCCURRENCE OF OESTRUS IN THE FEMALE GUINEA PIG. Edward W. Dempsey, William C. Young, Hugh I. Myers and David B. Jennison, Brown University. (Lantern; 15 min.)

In a recent report of the preliminary results obtained from a correlated anatomical, physiological and behavioristic study of the reproductive cycle in the guinea pig (*Am. J. Physiol.*, vol. 105), attention was called to the tendency of animals to come to heat during the late afternoon and evening hours. Two peaks of activity were detected. For animals observed during February and March a first peak occurred about 5 P.M. and a second between 10 P.M. and 2 A.M. For the same animals observed during April and May a first peak occurred about 7 P.M. and a second between 12 midnight and 2 A.M. This shift toward the early morning hours could be explained as a consequence of the lengthening days during the latter period.

If this is true, a similar shift in the opposite direction should occur during the autumn when the days are shortening. Between October 15th and November 8th animals have been observed during 107 cases of oestrus and such a shift toward the afternoon hours has occurred. Data from the longer period until December 15th can be presented, however, only in the final report.

In an effort to ascertain whether darkness or some other nocturnal factor is involved, forty animals have been isolated in a dark room. During the first oestrous cycle the behavior of these animals was not different from that of the larger group observed under normal conditions. Data from three succeeding oestrous cycles will be presented when the completed paper is read.

7. THE GROSS ACTION OF PROLACTIN AND GONAD-STIMULATING HORMONE ON THE MATURE OVARY OF THE FOWL. Robert W. Bates, Ernest L. Lahr and Oscar Riddle, Carnegie Institution of Washington. (Lantern; 10 min.)

Preparations of these two hormones (from anterior pituitary tissue), each proved to be essentially free from the other, now permit a study of differences in their effects on the mature gonads of animals. A difference (opposition) in their gross action on the mature testis of the dove is reported elsewhere (Endocrinology, November-December, 1933) and the present study considers their action on the mature ovary of domestic fowl.

The ovaries of laying hens, or of hens in or approaching reproductive rest in autumn, are markedly reduced in weight by twice daily intramuscular injections of prolactin, 8 mg. daily, during 9 or more days. Such ovaries are increased to weights much in excess of their 'normal' weight by twice daily injections, 4 mg. daily, of gonad-stimulating hormone. This also applies to ovarian weight after removal of all large follicles. Usually the large ova thus formed do not ovulate. The two hormones have opposite specific actions on the mature ovary.

White Leghorns, White Rocks and R. I. Reds were studied. Birds not in complete reproductive rest treated with prolactin showed reduction of comb, oviducts and width between pubic bones. Nearly all birds receiving gonad-stimulating hormone enlarged their combs (17 per cent, length; 27 per cent, height, in eleven Leghorns) and oviducts and relaxed their pubic bones (39 per cent in Leghorns). Comb, oviduct and pubic bones thus show definite tendency to change with ovarian size—as controlled by the two pituitary hormones—and in correspondence with changed ovarian output of estrin.

8. RELATION OF ADRENAL CORTICAL FUNCTION TO CERTAIN ASPECTS OF RESISTANCE. Ernest W. Blanchard, Bryn Mawr College. (Introduced by D. H. Tennent.) (Lantern; 10 min.)

The work of several investigators has indicated a possible relationship between adrenal cortical function and the efficiency of the resistance mechanisms of the body. To check this belief the effect of adrenalectomy, substitution therapy with cortical extract (Swingle and Pfiffner), and extract injections into normal animals has been studied in relation to the opsonin content of the blood serum as measured by the per cent of phagocytic cells in mixtures of known dilutions, of serum, antigen, and leucocytes. The method used in determining opsonic activity is one which can be carefully controlled and by which comparable results can be obtained at any time.

The results show a marked drop in the opsonin content of the blood of bilaterally adrenalectomized animals. The opsonin content of the blood of adrenalectomized animals maintained by injections of active extract is normal. The low opsonic activity of the blood of animals showing terminal symptoms of cortical insufficiency can be brought up to the normal level of injections by extract. Normal, unoperated, animals receiving large amounts of cortical extract show opsonin content figures higher than the normal.

The drop in opsonic activity of the blood of adrenalectomized animals is believed to be a specific result of adrenal insufficiency rather than the result of a metabolic derangement.

At the present time a series of experiments is being carried on to determine the relation of adrenal cortical function to other serological aspects of resistance.

9. THE EFFECT OF DAILY HETERO-PITUITARY IMPLANTS INTO ADULT BUT SEXUALLY INACTIVE MALE GROUND SQUIRRELS. G. E. Johnson and E. L. Gann, Kansas State College. (Lantern; 10 min.)

Four daily implants of rat anterior pituitary glands into twelve sexually inactive but adult male ground squirrels produced a marked enlargement of the testes (28 per cent average increase of three diameters) and seminiferous tubules (26 per cent increase in diameters), and caused a change in the cells of the latter from primary spermatocyte spireme stages to first maturation divisions, secondary spermatocytes, second maturation divisions (one animal) and spermatids (one animal). Lumina usually appeared in the tubules. These comparisons are between two pieces of the right testis taken before and after the four implantations.

Continuation of the implantations up to a total of eight, twelve or sixteen in the above animals produced further advances in size of testes and tubules (including lumen formation) and in spermatogenesis (in two cases to formation of spermatozoa), but these additional changes were not as great nor as constant as those already produced by the first four implants. The accessory reproductive organs were greatly increased in weight after eight to sixteen pituitary implants over those of controls given the same number of implants of brain tissue. These increases were: prostate, over two times; Cowper's, over four times; seminal vesicle, over five times. The glands also showed a great advance in cellular development, indicating a change from rest to active functioning.

10. INDUCTION OF EGG-LAYING IN THE SPANISH NEWT, *PLEURODELES WALTLI*. Helen M. Hilsman, University of Pittsburgh. (Introduced by H. H. Collins.) (Lantern; 7 min.)

Experimental induction of egg-laying has been successfully performed on some amphibia by the use of pituitary implants and extracts, and it seemed advisable to extend the results to include the Spanish newt, *Pleurodeles waltli*. The experiments were confined to one pair of salamanders which had been kept in the laboratory for about 5 years without laying eggs. Daily pituitary transplants of *Triturus viridescens* were made subcutaneously for a period of 24 days. A total of 120 implants were given. This treatment, although it failed to bring about amplexus or the induction of egg-laying, nevertheless did produce the secondary sexual characters. The newts were untreated for 12 days during which time no eggs were laid. Subsequently, injections of Antuitrin S were administered subcutaneously on alternate days. The day following the fourth injection 300 eggs were laid, the day following the fifth, 50, and the day following the sixth, 100. A seventh and final injection was administered 3 days later but it was not followed by another deposition of eggs. Additional egg-laying did not occur probably because the female was already spent. The male was not responsive to the same treatment and the eggs were not fertilized. Although egg-laying was not induced by the transplantation method, the cumulative effects of the pituitary implants probably prepared the way for the rapid response to Antuitrin S. It is likely that the combined effects of the implants and the injections were responsible, in this case, for the induction of egg-laying.

11. THYROXINE CONCENTRATION AND THE METAMORPHIC PATTERN IN ANURA.
William Etkin, University of Chicago. (Introduced by Carl R. Moore.) (Lantern; 12 min.)

In previous descriptive work on anuran metamorphosis it had been shown that metamorphic events are arranged in a definitely timed sequence. The present study is concerned with the possible role of thyroxine concentration in determining the normal pattern of events. *Rana cantibrigensis* tadpoles were operated upon for the removal of the thyroid anlage and when half to fully grown were subjected to various thyroxine concentrations. The sequence of metamorphic events was observed in the living animal. From an analysis of the results the following conclusions were drawn.

1. The sequence of events is independent of the concentration used, being essentially normal in all concentrations.

2. The rate of response is a function of the concentration. The time required for a given event to occur rises first slowly, then rapidly as the concentration of thyroxine is lowered.

3. Neither the size of the animal nor the presence or absence of the thyroid gland in later tadpole stages plays any significant role in the nature of the response.

4. The normal time relationships of the events in sequence cannot be attained by any single concentration but requires the action of increasing concentrations of thyroxine.

5. An interpretation of the role of thyroid activity in the production of the normal metamorphic pattern is offered.

By title

12. A HITHERTO UNNAMED FACTOR OF THE HYPOPHYSIS OF THE INFANTILE RAT.
Olive Swezy, University of California.

The hypophysis of the rat is actively secreting growth hormone at the time of birth, as shown by implants in hypophysectomized rats, but the maturity hormone is not found up to day 13 by the same test. There are no evidences of the presence of the maturity hormone in the ovary of the normal rat before about the eighteenth day, yet implants of hypothyses of rats 1, 5, 10 and 13 days old into normal rats of 21 days induce maturity hormone effects. The growth hormone alone will not produce these results, hence some other factor must be present in the hypophysis of the young rat during this time. Since these effects cannot be induced in the absence of the hypophysis of the host, they must be the result of its sudden stimulation to hormone production by this factor in the infantile implants. Is this another hormone of the anterior pituitary? Between days 13 and 21 the hypophysis of the rat becomes able to secrete the maturity hormone, coincident with the time when precocious sexual maturity may be induced for the first time.

13. TRANSPLANTATION OF THE ADULT HYPOPHYSIS INTO SALAMANDER LARVAE.
Robert K. Burns, Jr., University of Rochester.

When the adult hypophysis is grafted into larval salamanders (*Amblystoma tigrinum*) at the stage of sex differentiation rapid melanosis follows, due to increase in melanophores and deposition of granular melanin. The normal color pattern is obliterated and the specimen becomes sooty black. Growth in general is not affected and metamorphosis is not hastened, but there is a change in skull form interpreted as acromegaly.

The gonads of male larvae are profoundly stimulated, showing slight but definite acceleration of growth as early as 24 days (one case); marked growth, with precocious histological differentiation at 55 days (four cases); and a six- to eightfold increase in volume at 105 days (metamorphosis), with spermatogenesis practically complete in the proximal lobules of the testis (five cases). In specimens showing spermatogenesis the wolffian ducts (vasa deferentia) are hypertrophied. The effects are confined to cases in which a growing graft was recovered, cases in which no graft was found being negative. The spermatogenesis thus induced in metamorphosing larvae appears cytologically normal.

Ovaries of females reared from the same eggs show no response to such grafts. The results are interpreted on the basis of different hormone thresholds for stimulation during larval life. The testis is apparently responsive to a given concentration much earlier than the ovary.

14. HISTOLOGICAL EFFECTS OF POTASSIUM IODIDE AND THYROID SUBSTANCE ON THE THYROID GLAND OF THE GUINEA PIG IN EXPERIMENTAL SCURVY. W. Fulton Abercrombie, New York University. (Introduced by Daniel Ludwig.)

Experimental scurvy was produced in young guinea pigs by feeding a diet consisting of alfalfa meal and wheat flour, mixed in equal amounts by weight, and moistened with water. Whole oats and tap water were supplied ad libitum. In chronic scurvy this diet was supplemented with 0.5 cc. of orange juice every second day.

The thyroid gland in scurvy possesses irregular follicles with a heightened epithelium, a reduced amount of non-uniformly stained but extensively vacuolated colloid, and an increased number of interfollicular cells. These changes are more marked in chronic scurvy of long duration than in acute scurvy.

Potassium iodide, when administered to animals with scurvy, causes a decrease in the number of vacuoles and an increase in amount of colloid accompanied by a flattening of the epithelium, and a decrease in the number of interfollicular cells. Thyroid substance produces similar changes except that the epithelium is more nearly of normal height. Potassium iodide and thyroid substance, in the doses administered, do not tend to prolong the life of the animal in experimental scurvy, even though they offset the action of scurvy on the thyroid gland. Therefore, it appears that vitamin C is not concerned with iodine metabolism.

15. SEXUAL CONDITIONS IN *TRITURUS VIRIDESCENS*. ARTIFICIAL HERMAPHRODITISM WITH PITUITARY TREATMENT. (MALE HOSTS WITH OVARIAN GRAFTS.) A. E. Adams and Josephine Dudley, Mount Holyoke College.

Artificial hermaphrodites were made by transplanting one ovary into normal or unilaterally castrated male *Triturus*. Some animals received homoplastic transplants of whole pituitary or injections of phyone daily for 16 days or semi-weekly for 8 weeks (control engrafted with muscle or injected with 0.6 per cent salt solution). This series was killed after 8 weeks. The rudimentary müllerian duct of the host was used as a criterion of ovarian influence.

In control hermaphrodites, slight stimulation (indicated by cilia) of the duct anterior to the kidney and almost none in the duct paralleling the kidney had occurred when compared with the ducts of normal males. With pituitary treatment, the ducts anterior to the kidney responded considerably as judged by 1) increase in number and height of cells, 2) increase in diameter and lumen of duct, 3) presence of cilia. The duct parallel to the kidney responded less.

Further analysis of the data indicated 1) that size and yolk-forming activity of ovaries was correlated with degree of hypertrophy of ducts, 2) that pituitary transplants were more effective than phyone, 3) that semiweekly treatment for 8 weeks was more effective than daily treatment for 16 days, 4) that ducts in hermaphrodites with one testis responded more than those in hermaphrodites with two testes.

The results indicate that the effectiveness of ovarian grafts in normal or unilaterally castrated males can be increased by pituitary administration and offer further evidence of a pituitary-gonadal relationship in *Triturus viridescens*.

16. CHANGES IN ADRENALS OF NEWTS FOLLOWING HYPOPHYSECTOMY OR THYROIDECTOMY. A. E. Adams and Elizabeth M. Boyd, Mount Holyoke College.

A preliminary study of the adrenals of normal, hypophysectomized and thyroidectomized newts (*Triturus viridescens*) was made to determine whether any change occurs in the size and histological picture of these glands after the removal of pituitary or thyroid. Volume of cortical tissue was determined for six animals of each type and the average for each group was secured. At 3 months after either operation it was found that the average absolute volume of the cortex had decreased when compared with that of normal animals (normal, 20.42 cu.mm.; thyroidectomized, 16.89 cu.mm.; hypophysectomized, 17.81 cu.mm.). However, the range of volume determinations of the six animals in each group overlaps so much that further data must be secured to establish the apparent decrease in average volume. A relative increase of cortex to body weight had occurred due to loss of body weight in the operated animals.

The histological picture of the cortex at 3 months after either operation or after both operations simultaneously performed on an animal had also changed, there being a lessened fat content and some decrease in cell size in all types of operates and in hypophysectomized newts a decrease of nuclear size also. These histological changes were more apparent at 5 months after the operations (hypophysectomy or thyroidectomy). (No estimation of cortical volume was made at 5 months.) The histological appearance of the medulla seemed unaltered after thyroidectomy or hypophysectomy, but no attempt was made to determine possible volume changes because of the scattered distribution of the medullary tissue.

17. STUDIES ON THE FEMORAL PAD OF *TRITURUS VIRIDESCENS*. C. M. Pomerat, Harvard University. (Introduced by A. B. Dawson.)

In order to test the persistence of grafted tissue, auto- and homoio-transplantations of hind leg pads of male *Triturus viridescens* were made to an area in the midventral line between the forelimbs. These animals were stimulated at various intervals by pituitary substance (intraperitoneal implants of frog antero-pituitary and Parke, Davis & Co. whole sheep gland extract). Autotransplants were always found to persist unchanged as evidenced by typical pad response to anterior-pituitary stimulation as described by Adams and confirmed by Dawson and Jimenez. These findings include animals which have been under observation for more than 300 days. Persistence of grafted tissue was never observed in homoio-transplants. Progressive removal or rearrangement of grafted tissue was evidenced by the inhibition of characteristic hypertrophy and pigmentation of pad tissue following pituitary stimulation; even though the pads normal to the host showed, at least in the early part of the process, definite response. Regeneration of the femoral pad in the denuded area was never observed. Amputated limbs were found to regenerate in the manner described by Collins. Toes were found to respond to pituitary stimulation by hypertrophy and pigmentation soon after they had become differentiated (70 days) while femoral pads were not observed on regenerated legs even after 150 days following amputation.

18. THE QUESTION OF SEX SPECIFICITY AND THE PREVENTION OF CASTRATE CELLS IN THE ANTERIOR PITUITARY. Philip V. Rogers, Hamilton College. (Introduced by Earl O. Butcher.)

Daily injections of 15 R.U. of Theelin (furnished by Parke, Davis & Co.) were begun in young female rats immediately after ovariectomy and continued for 2 months. The pituitaries of injected females appeared normal, while that of a castrate control was filled with castrate cells. In another group of females the castrate cells were allowed to form for 7 weeks; then Theelin injections of 25 R.U. were started. By 15 days the pituitaries had returned to normal.

Young male rats were castrated. Injections of 15 R.U. of Theelin, started immediately, prevented the formation of castrate cells. Injections started after castrate cells had formed caused the gland to return to normal.

At the time of gonadectomy, testes were implanted into young female rats. Six weeks later the animals were examined. It was found that the implants persisted best when the testis was firmly sutured to the cut end of the ovarian blood vessels. In those whose implants showed complete degeneration, the pituitaries were filled with castrate cells. Where the testicular implants had taken, the pituitaries were normal.

From the above it appears that the female sex hormone, Theelin, will prevent castrate cell formation in both sexes, and that implanted testicular material will keep castrate cells from forming in gonadectomized females. Therefore, in its relation to the prevention of castrate cells in the anterior pituitary body, the sex hormone is not sex specific.

PHYSIOLOGY

Read

19. NUTRITION OF *MELANOPLUS DIFFERENTIALIS* THOMAS (ORTHOPTERA: ACRIDIDAE) ON A DIET OF BOILED WHEAT LEAVES, ALONE AND SUPPLEMENTED WITH ACCESSORY FOODSTUFFS. Charles Hodge, IV, Temple University. (Introduced by P. P. Calvert.) (Charts; 10 min.)

Three hundred and fifteen grasshoppers were fed diets of wheat leaves boiled for 10 minutes, fed alone or with carotin, whole yeast, orange juice, lime juice, cod liver oil, and cod liver oil extract, separately and in combination, representing the vitamins A, B, C, and D.

Previous work had shown wheat to be a complete and satisfactory diet, in fresh condition. Leaves boiled 10 minutes were unsatisfactory as sole food. Insects so fed survived on an average 7.2 days, and died as first instar nymphs. Prolonged boiling or boiling for as little as 10 minutes had the same result.

None of the additions except orange juice permitted more satisfactory growth than the boiled leaves alone. Numerous insects fed on boiled wheat leaves and orange juice passed through the second and succeeding instars, and one became adult.

It is concluded that boiling the leaves destroys their nutritional value for this insect, that this species seems to be unaffected by vitamin C but that some factor in orange juice, lacking in lime juice, is supplemental to the boiled wheat. Addition of vitamins A, B, and D to the boiled wheat seems to have no effect.

20. THE INTERRELATIONS OF DIFFERENT TECHNIQS AND CRITERIA FOR THE MEASUREMENT OF THE GROWTH OF YEAST. Oscar W. Richards, Yale University. (Lantern; 12 min.)

Different criteria for the measurement of growth give related but different pictures of the growth of the organism studied. Unless the several criteria are used simultaneously on the same experiment it is not possible to translate measurements made with one criterion directly into those of another. The several different criteria for studying the growth of yeast have been used simultaneously to measure the growth of a pure strain of *Saccharomyces cerevisiae* Hansen. The number of cells per unit volume of medium was estimated from counts with the haemocytometer and from colony counts obtained with the usual bacteriological plating technic. The birth rate was measured as the percentage of buds and the death rate as the percentage of the injured or dead cells staining with methylene blue. The total volume of yeast was determined by centrifuging the cells into calibrated tubes and then the cells were washed and dried to a constant weight. The photoelectric nephelometer gave data involving both the sizes of the cells and the population density. The distribution of the sizes of cells present at a given time and the average size of the cells was determined. The interrelations of the different measurements are used to give a more complete picture of the growth of a population of yeast than has hitherto been obtainable.

21. REDUCTION OF ISLETS IN THE PANCREAS OF FISH BY MEANS OF DIET, LACK OF EXERCISE, AND OVERHEATING. Walter N. Hess, Hamilton College. (Lantern; 10 min.) (Also by demonstration.)

Rainbow trout, 10 weeks old, were divided into groups of 300 each and fed the following diets: Diet 1, beef liver; 2, beef liver plus 10 per cent of lard; 3, beef liver plus 10 per cent lard and 20 per cent cooked corn starch. In diets 4 to 6 inclusive beef heart was substituted for liver, and in diets 7 to 9 inclusive pig spleen was substituted. Some groups of fish were fed three times, some six times and others eight times daily. In some troughs water was regulated to flow 1 gallon, and in others 12 gallons per minute.

After 120 days, uniform sized fish (52 mm.) from groups 1, 4, and 7 had an average of 73.5 islets while those from all other groups combined that were studied averaged 26.1 islets. Fish fed three times daily and kept in fast flowing water had larger number of islets than those fed eight times daily and kept in slowly flowing water, and those that received diets 3, 6 and 9 had fewest islets. Reduction of islets was always associated with fatty infiltration of the pancreas accompanied by apparent lessened blood supply to this organ. Cataract was not uncommon but was only found in fish with low islet counts. These experiments suggest that islet reduction may be due to fatty infiltration and lessened blood supply to the pancreas and that the same factors that cause islet reduction may also cause cataract.

22. REGENERATION OF THE ISLETS IN THE PANCREAS OF FISH. Walter N. Hess, Hamilton College. (Lantern; 5 min.) (Also by demonstration.)

Rainbow trout with low islet count, and of uniform size, were divided into six groups of fifty each. Groups 1, 2 and 3 had previously been fed beef liver plus 10 per cent lard and 20 per cent cooked corn starch, while for groups 4, 5 and 6 pig spleen was used in place of beef liver. For study of islet regeneration, fish in groups 1, 2, 4 and 5 were given the same diets described above which had caused pancreas degeneration. Those in groups 3 and 6 were fed only beef liver and pig spleen respectively.

Fish in groups 2 and 5 were given, for 70 days, daily stomach injections of $\frac{1}{10}$ cc. of 30 per cent choline hydrochloride. By the end of 2 weeks it was evident that fat was disappearing from the liver and pancreas. By the end of 70 days these organs were nearly free of fat and the islet count had greatly increased. Fish in groups 1 and 4 (controls) showed no improvement in these respects. Fish in groups 3 and 6 which were fed liver and spleen respectively, with no addition of fat or carbohydrate, showed definite improvement in the pancreas, with increased islets, especially in those fed liver. These experiments on fish together with those on degeneration reported elsewhere suggest that lack of exercise, overeating and improper diet may cause abnormal fat metabolism and islet reduction also in man, and that this may be remedied by proper diet, exercise and use of choline.

23. COMBINATIONS OF CURRENT AND ANTECEDENT CONDITIONS AFFECTING THE PRODUCTION OF WINGS IN APHIDS. A. Franklin Shull, University of Michigan. (Lantern; 15 min.)

Two stocks of aphids kept for months or years at 24° and 14°C. respectively have been drawn upon repeatedly for parents in experiments in which the aphids are reared at two temperatures (24° and 14°), in two light conditions (continuous, and alternating light and darkness), and from two kinds of parents (winged and wingless). The various combinations of these pairs of alternatives require sixteen types of experiment. In one strain of aphids over 100,000 offspring have been obtained, with the following results. More winged offspring were produced in continuous light than in alternating light and darkness in every combination. More winged offspring were obtained at 24° than at 14° in all combinations but one; in that one the difference was probably insignificant. Parents from a 24° stock yielded more winged offspring than those from a 14° stock provided the parents were winged, but fewer if the parents were wingless (though in the latter category one difference was probably insignificant). Whether the parents were winged or not made in general less difference than the environmental conditions. In five of the eight environmental combinations winged parents yielded fewer winged offspring than did wingless parents (one perhaps insignificant); while in three of the eight, winged parents produced more winged offspring than did wingless parents (two perhaps insignificant). Other strains of aphids do not show the same relations, and it is not expected that any single rule of wing-production based on conditions or changes of conditions can be stated.

24. THE EFFECT OF HOMOTYPIC CONDITIONING OF WATER ON THE GROWTH OF FISHES AND CHEMICAL STUDIES OF THE FACTORS INVOLVED. W. C. Allee, E. S. Bowen, J. C. Welty and R. Oesting, University of Chicago. (Lantern; 15 min.)

Young *Platylocilus* and *Amieurus* isolated in homotypically conditioned well water grew more rapidly than accompanying fishes in similar but unconditioned water. Young goldfishes show the same relations in an artificial pond water. Biological conditioning, whether by fishes or by mussels, results in an increase in ammonia and nitrites; nitrates also increase, particularly in long conditioned water. Organic nitrogen compounds and other organic substances are produced. Goldfishes give off electrolytes into distilled water, but there is no change in total electrolytes as a result of 22-hour conditioning of well water or artificial pond water by fishes. Goldfishes survive isolation in unconditioned distilled water for fewer days than if the water is homotypically conditioned. They survive indefinitely in the unconditioned artificial pond water. Death in distilled water is caused by loss of electrolytes rather than by osmotic unbalance. Removing faeces from unconditioned water does not affect its growth-promoting qualities. The growth-promoting principle is an organic substance which gives a positive biuret test, is heat resistant at 121°C., and can be prepared in concentrated form, autoclaved and diluted to usual concentration without losing its potency.

25. SODIUM CHLORIDE CYTOLYSIS IN THE SEA URCHIN EGG. D. Mazia, University of Pennsylvania. (Introduced by L. V. Heilbrunn.) (5 min.)

In isotonic sodium chloride solutions, *Arbacia* eggs are known to undergo cytolysis; their pigment granules break down and the cells become filled with numerous small vacuoles. The egg volume increases greatly. Vacuolization proceeds from the periphery inward, and after the vacuoles begin to appear, their increase in number is very rapid. In the case of eggs washed repeatedly in sodium chloride solution, most of the eggs are completely cytolysed in 2 to 4 hours. Cytolysis is favored by hypertonic solutions, also by acidity.

If one seeks to interpret cytolysis as an internal surface precipitation reaction (compare Heilbrunn, '28), it is very difficult to understand the mechanism of sodium chloride cytolysis. The surface precipitation reaction requires calcium and it is not clear why immersion in sodium chloride solution should favor a reaction which depends on calcium. But paradoxically enough, prolonged immersion in sodium chloride solutions actually causes a release of free calcium in the cell interior. The presence of the free calcium could be demonstrated by staining eggs with sodium alizarinsulfonate. Such eggs show no calcium test until it is time for cytolysis to begin. At this point they show a very clear calcium reaction. It thus appears that sodium chloride may initiate cytolysis by releasing calcium in the cell interior.

26. ELECTROKINETIC STUDIES OF MARINE OVA. Katsuma Dan. (Introduced by L. V. Heilbrunn.) (Lantern; 5 min.)

By using the previously described method for determining the cataphoretic velocity of marine eggs, which consists in measuring the horizontal displacement from the vertical path of fall, the following additional facts were observed:

1. Cataphoretic speed of *Arbacia* eggs is strictly proportional to the applied potential gradient within the range of the experiment.

2. *Arbacia* eggs killed by heat (40°C. for 5 minutes) have a charge of -30.7 ± 0.68 mv., which is practically identical with that of normal eggs (normal eggs without jelly have a charge of -30.0 ± 0.47 mv.).

3. When *Arbacia* eggs are fragmented by centrifuging into lighter and heavier halves, the lighter halves show significantly less negative potential than heavier halves or intact eggs.

4. The charge of *Asterias* eggs with jelly is -19.0 mv.; without jelly, 19.9 mv.; killed eggs from which jelly had previously been removed have a charge of -19.0 mv.

5. The charge of *Cumingia* eggs with jelly is -34.1 mv.; without jelly, -28.8 mv.

6. Less accurate data for other forms are as follows: *Echinarachnius* eggs with jelly, -31.6; without jelly, about -19.7; *Nereis*, about -10.0 mv. The chorion of *Cerebratulus* eggs is negatively charged but the eggs themselves when removed from the chorion have zero charge.

27. THE EFFECT OF MECHANICAL STIMULATION ON THE PROTOPLASMIC VISCOSITY OF AMOEBA. C. A. Angerer, University of Pennsylvania. (Introduced by L. V. Heilbrunn.) (5 min.)

Amoeba proteus and *Amoeba dubia* were agitated in a shaking machine which could be operated at varying frequencies and with varying amplitudes of motion. The viscosity of the protoplasm was then determined by the centrifuge method, *A. proteus* being used for a study of the plasmagel, *A. dubia* for the plasmasol. Vigorous agitation causes a decrease in the viscosity of the plasmagel. The effect is greater with increased frequency of agitation. At a given frequency, the viscosity decreases progressively from minute to minute, until after several minutes a minimum value is arrived at. Further agitation, which may be continued until the amoebae break up, then produces no further effect on the viscosity. The plasmasol behaves somewhat differently. Agitation first causes a decrease in viscosity. Then, as agitation is prolonged, the viscosity of the plasmasol rises until it attains a value above the normal. The results obtained with this type of mechanical stimulation thus parallel the results obtained by Heilbrunn and Daugherty ('33) with ultraviolet radiation.

28. CHANGES IN THE OXIDATION-REDUCTION POTENTIAL AND pH OF BACTERIA-FREE CULTURES OF CHILOMONAS. Theo. L. Jahn, Yale University. (Lantern; 10 min.)

Changes in oxidation-reduction potential and in pH of bacteria-free cultures of *Chilomonas paramecium* have been measured with a vacuum tube potentiometer and platinum and glass electrodes. The apparatus utilizes a type K potentiometer and a screen-grid tube operated at free grid potential (Du Bois, '30). The glass and platinum electrodes and agar bridges were autoclaved and then inserted into flasks of medium inoculated with *Chilomonas*.

Freshly inoculated broth of hydrolyzed casein and phosphates has a pH value of 6.60 and an Eh value of +400 to +420 mv. Readings of the potential and pH were made every 1 to 4 hours for 5 days on several experiments. The Eh drops as growth proceeds and at the end of 36 to 72 hours (dependent upon size of the inoculum) reaches a minimum of +120 mv.; pH changes are slight (to 6.76). However, if Na-acetate is added to the broth, growth is much more rapid, pH changes are greater (to 7.54) and the Eh reaches a minimum of -20 mv. This agrees with colorimetric observations (Jahn, '33).

These changes of Eh (280 to 300 mv. without acetate and 420 to 440 mv. with acetate) are changes in the medium which have not been demonstrated heretofore with protozoa, and which are believed to be of importance in interpreting changes of growth rate during different phases of a culture and in interpreting the problems of cell contiguity (autocatalysis and allelocatalysis).

29. THE EFFECT OF OXYGEN TENSION ON OXYGEN CONSUMPTION OF A DEVELOPING EGG (ORTHOPTERA). Joseph Hall Bodine, State University of Iowa. (Lantern; 10 min.)

A study has been made of the effects of oxygen tension on oxygen consumption of the egg of an insect, the grasshopper, *Melanoplus differentialis*. Within

rather wide ranges, the oxygen consumption is independent of the oxygen tension of the environment. No significant differences in reaction between non-diapause and diapause types of eggs have been noted for tension of 160 mm. mercury and below. Eggs in diapause show marked reactions to high tensions of oxygen (380 mm. and 760 mm. mercury), the degree of reaction being apparently conditioned by the physiological state of the eggs at the period of exposure.

30. THE CIRCULATION OF BLOOD IN THE FROG'S KIDNEYS IN RELATION TO THE ANURIA PRODUCED BY ASPHYXIA. Edward F. Adolph, University of Rochester. (Lantern; 10 min.)

When frogs were deprived of oxygen the formation of urine ceased. After pithing them the blood flow in their kidneys was examined, and it was found that all the glomeruli became inactive, regaining their blood supply as soon as oxygen was readmitted. The renal arteries remained filled with pulsating blood during the asphyxia but the arterioles and glomerular afferent vessels constricted completely. In no other part of the body, including the renal portal system, did the blood flow cease during asphyxia. Four per cent of oxygen at 24°C. was sufficient to reopen the renal afferent vessels.

There was no relation between oxygen tension and intermittent periods in glomerular blood flow; and indeed intermittency was not found to prevail in the normal circulation. The number of inactive glomeruli was not influenced by the present or previous oxygen tension above 4 per cent of oxygen.

Although the arterial blood pressure fell in response to asphyxia, its level had no relation to the stoppage of renal arterioles. Similar decreases of blood pressure and heart rate, produced by vagus stimulation and by amyl nitrite, did not stop the glomerular circulation. The response to asphyxia was not prevented by intravenous infusions of salt solution or urea solution. Destruction of the sympathetic nerves supplying the kidney interfered but slightly with the response. Simple asphyxia, therefore, reproduces the 'Nussbaum experiment' without surgical intervention.

31. MAMMALIAN RELATIONSHIPS BY THE PRECIPITIN TEST. Harold R. Wolfe, University of Wisconsin. (Introduced by Alan A. Boyden.) (Lantern; 15 min.)

The serological relationships of twenty-eight mammals were determined by the precipitin test. Antiserums against the bloods of nineteen species of the orders Primates, Ungulata, Perissodactyla and Carnivora were used. These antiserums were for the bloods of man, chimpanzee, baboon, *M. rhesus*, horse, pony, mule, ox, sheep, goat, buffalo, Virginia deer, pig, dog, fox, cat, mink, fitch and skunk. In most cases distinct order reactions were noted and the degree of relationships within the order determined. To verify results reciprocal relationships and comparisons of the reactions of closely related serums were made.

By absorbing an antiserum with a related heterologous antigen a species-specific serum was produced in most cases. This method enabled one to make a very clear distinction between sheep and ox bloods, *Macacus* and human bloods and between other closely related forms.

Rabbits were used for production of antibodies. Injection of rabbits every other day for the first three or four doses prevented loss of animals by anaphylactic shock. Usually six injections were given and good titers resulted when the total quantity of antigen used was as low as 10 cc.

Antiserums in many cases were diluted 1:2 with a buffered physiological salt solution. This gave more precise readings of the 'ring' tests and enabled a larger series of reactions to be made when the amount of serum was limited. The diluted serum gave practically an identical specificity and relationship value as did the undiluted. Higher dilutions, however, affected both specific and relationship value.

32. EFFECTS OF FREEZING IN LIQUID AIR ON THE EXCISED HEART OF TURTLES.

E. Alfred Wolf and Richard A. Torgesen, University of Pittsburgh. (Lantern; 10 min.)

Excised hearts of turtles were immersed in liquid air ($-192^{\circ}\text{C}.$) for 3, 5, 7, and 10 minutes respectively. They were then placed in ice-cold Ringer, the temperature of which was allowed to rise gradually to room temperature. Oxygen was bubbled through the Ringer.

The hearts resumed their beats a few minutes after immersion in the Ringer. The records of the beats showed the following characteristics: the beats were at first irregular and slow, but within a few minutes quite regular only slower than controls. The amplitudes of the beats for controls and experimental hearts showed a gradual decline within the 3-hour period of recording. This decline is more pronounced in the experimental ones, the rate of decline depending on the length of exposure to liquid air. In controls the base-line of the record is straight, in experimental ones the level of the curves is raised at irregular intervals of $\frac{1}{2}$ to 2 minutes for ten to twenty beats after which the curves would return to the level of the base-line of the record.

Hearts exposed to freezing for longer periods than those mentioned would not resume their automatic activity.

33. EFFECTS OF ENVIRONMENTAL CONDITIONS ON LONGEVITY. Lester Ingle, Brown University. (Introduced by A. M. Banta.) (Lantern; charts; 15 min.)

In an attempt to determine the effects of environmental conditions on longevity, Cladocerans were reared in a normal food medium which had been diluted from twenty-four to thirty-six times with pond water.

There are several effects of this treatment. Attainment of reproductive maturity is delayed, the size of the parthenogenetic broods is decreased, and the interval between broods is lengthened. The growth increments are especially decreased. However, the most striking effect is that animals reared in the limited supply of food have a longer duration of life than have control animals (sibs) reared in normal medium.

Data from one series of *Daphnia longispina* showed that the retarded mothers produced 116.8 (57.20 per cent) fewer young than did those reared under optimum conditions, but lived 3.83 (11.8 per cent) days longer. Another series of *D. longispina* gave similar results with an even larger differential; retarded mothers released 143.17 (57.06 per cent) fewer young, but lived 19.15 (68.4

per cent) days longer. In a series of *Moina macrocopa* the retarded mothers released 31.35 (30.49 per cent) fewer young and lived 4.83 (53.6 per cent) days longer.

These controlled experiments seem to demonstrate a marked effect of environmental conditions on longevity.

34. FURTHER STUDIES ON THE LONGEVITY AND SWIMMING ABILITY OF SPERMATOOZA.
B. H. Grave, De Pauw University. (Lantern; 10 min.)

In a reinvestigation of the swimming ability of the spermatozoa of *Arabacia* and *Cumingia* it was learned that they may swim approximately 20 cm. Some lots of sperm of each species swim farther than others of the same species. In all cases the rate of swimming slows down after $2\frac{1}{2}$ hours and little progress is made after the lapse of that period of time. Spermatozoa are more or less active for 10 hours and the rate is about as follows: Seven cm. are traversed in 40 to 50 minutes; 9 cm. in 1 hour; 12 cm. in $1\frac{1}{4}$ to $1\frac{1}{2}$ hours; 15 cm. in $1\frac{1}{2}$ to $2\frac{1}{2}$ hours; 16 cm. in $2\frac{1}{2}$ to 5 hours; and 18 cm. in $5\frac{1}{4}$ to 9 hours. Ability to fertilize eggs was retained to the end.

35. THE EFFECT OF ETHYL URETHANE ON BACTERIAL RESPIRATION AND LUMINESCENCE AND ON THE CYPRIDINA LUMINESCENT REACTION IN VITRO. G. Wellford Taylor, Princeton University. (Introduced by E. N. Harvey.) (Lantern; 7 min.)

Low concentrations of urethane stimulate bacterial luminescence, higher concentrations cause reversible narcosis, still higher concentrations produce irreversible changes. This relation of effect to concentration holds for respiration but the concentrations are much higher, so that concentrations sufficient to inhibit luminescence may at the same time stimulate respiration. Urethane stimulates respiration only when the bacteria are in a non-nutrient medium, and reversibly inhibits respiration only when the bacteria are in a nutrient medium. Apparently in a non-nutrient medium the respiratory rate is too low to be lowered further by narcotic, and in a nutrient medium the respiratory rate is too high to be raised further.

Low concentrations of urethane increase the velocity constant of the *Cypridina* luminescent reaction in vitro, just as they did the luminous intensity of bacterial suspensions; concentrations slightly higher than those required to inhibit bacterial luminescence inhibit the *Cypridina* luminescent reaction, decreasing both the total amount of light produced and the velocity constant of the reaction. It can be clearly demonstrated that the narcotic in this case exerts its effect by inactivating the enzyme, luciferase, and it seems probable that this is also the manner in which bacterial luminescence is inhibited. This inactivation is probably brought about by an adsorption of the narcotic on the enzyme, as suggested by Warburg, but it is difficult to explain stimulation on the basis of an adsorption of the narcotic.

36. THE LIGHT INTENSITY OF LUMINOUS BACTERIA AS A FUNCTION OF OXYGEN PRESSURE. Herbert Shapiro, Princeton University. (Introduced by E. Newton Harvey.) (Lantern; 7 min.)

As an extension of the primary observation of Harvey and Morrison (Jour. Gen. Physiol., 6, 13, '23) who determined the minimum oxygen concentration for light just perceptible visually, the exact mode of variation of luminous intensity of a fresh water bacterium, *Vibrio phosphorescens*, with oxygen tension was investigated by means of a sensitive photocell and amplification for the low intensities involved. Oxygen free nitrogen, mixed with air after passage through flow meters, was passed as a stream of very fine bubbles through a suspension of bacteria contained in a suitably constructed chamber placed before the photocell. Light intensity is independent of oxygen pressure until one descends to a concentration of about 0.14 per cent (the dimming region) whence the light falls off rapidly, being extinguished (as detected by the photocell) at about 0.01 per cent oxygen (0.076 mm. mercury). Analysis of the data indicates as a possible explanation the adsorption of oxygen on luciferase as the controlling factor in the functional dependence of luminescence of this species on oxygen. Qualitative observations of the luminescence made with oxygen pressures of about 1500 pounds, applied until extinction of the light, showed a partially reversible decrease in intensity. Bubbling of oxygen through a suspension diminished the luminescence, which could be restored subsequently by replacing the oxygen by air.

37. SOME EFFECTS OF X-RAY IRRADIATION ON DEVELOPING GRASSHOPPER EGG. Titus Carr Evans. State University of Iowa. (Introduced by J. H. Bodine.) (Lantern; 5 min.)

Eggs of *Melanoplus differentialis* have been irradiated with intensities of from 100 to 5000 R. units just before the beginning of the later stages of development. Changes in rates of oxygen consumption together with visible changes in the morphology have been noted for individuals from the time of irradiation to hatching (as in low intensities) or death (as in high intensities). It has been found that increases of oxygen consumption rate are closely related to developmental processes. The lower intensities caused effects which were immediate, slight in extent, and temporary in duration. The full effects of heavy intensities did not appear immediately but were more evident and permanent when they did become apparent.

38. REACTIONS OF *DROSOPHILA* TO 2537Å RADIATION. Frank E. Lutz, American Museum of Natural History, and E. N. Grisewood, New York University. (10 min.)

Although this ultraviolet light is of a shorter wave length than occurs in insect habitats, *Drosophila* reacted to it as to rather intense ordinary light. Apparently they see it directly, not indirectly through fluorescence.

39. THE RELATION OF YELLOW COAT COLOR TO THE INCIDENCE OF SPONTANEOUS MAMMARY TUMORS IN MICE. C. C. Little, Roscoe B. Jackson Memorial Laboratory. (Lantern; 15 min.)

Virgin female mice of F_1 and F_2 generations derived from a cross between a high tumor non-yellow strain and a low tumor yellow strain are used as material.

The incidence of spontaneous mammary tumors in these animals shows:

1. A significantly higher incidence of such tumors in non-yellow mice than in yellows of the comparable generation.
2. A significantly earlier incidence of such tumors in the yellow mice.
3. A distinct difference in mean age incidence of mammary tumors and other tumors in both yellows and non-yellows.
4. A group of general physiological tendencies in yellows which suggests a possible explanation for the observed facts.

40. THE DISTRIBUTION OF PRESSURE IN THE HUMAN FOOT. Herbert Elftman, Columbia University. (Introduced by Secretary of Section F.) (Motion pictures; 15 min.)

By means of a new type of barograph it has been possible to record the changes in the distribution of pressure in the foot during movement. Analysis of the records provides information concerning the mechanics of the foot and the physiology of locomotion.

41. THE EFFECT OF BARBITURATES IN NORMAL AND NEPHROPATHIC MAMMALS. Theodore Koppanyi and W. S. Murphy, Georgetown University. (Lantern; 5 min.)

Barbital (veronal) is a drug which is excreted almost exclusively by the kidneys (75 per cent or over), other barbituric acid derivatives (pernoston, amytal, dial, etc.), however, are excreted in far smaller percentages (3 to 30 per cent). Mammals with both kidneys removed do not recover from barbital anesthesia, but do recover from other barbiturate depressions before they eventually die of uremia. The administration of different poisons such as uranium acetate, potassium chromate and tartaric acid produces widespread degeneration in the tubules (nephrosis). These nephropathic animals behave to barbital or to the other barbituric acid derivatives essentially as nephrectomized mammals do. They do not recover from the barbital depression, excrete only a very small percentage of the barbital injected, and show a retention of barbital in the blood and organs. However, they do recover after the administration of barbiturates other than barbital.

42. THE EFFECTS OF BARBITURATES IN THE FOWL. W. S. Murphy and T. Koppanyi, Georgetown University. (Lantern; 5 min.)

The fowl provided for our barbiturate experiments another 'experimentum mirabile.' The fowl behave to barbituric acid derivatives as nephropathic mammals do. A normal fowl excretes only some 15 to 35 per cent of barbital, shows retention of barbital in the blood and organs and does not recover and eventually

dies from the effects of barbital. The other barbituric acid derivatives, however, produce only a depression of short duration in the fowl and the recovery is complete. The excretory efficiency of the avian kidney as measured by the excretion of phenol red, approximates that of the human. Nevertheless, the fowl is unable to concentrate barbital in the urine. Whereas mammals after large doses may show the presence of 3 to 6 mg. of barbital per cubic centimeter of urine, the fowl cannot concentrate it over $2\frac{1}{2}$ gm. per cubic centimeter.

43. COMPARATIVE PHARMACOLOGY. Theodore Koppanyi, Georgetown University. (Lantern; 5 min.)

In view of the knowledge gained by comparative morphology and physiology, it seems useful to introduce the more frequent application of pharmacological methods in comparative zoölogy. The main reason for this lies in the fact that very often pharmacological methods, i.e., the reaction of tissues and organs to specific drugs will furnish more accurate and sensitive clues not only as to the function but sometimes even to the homology of the organs studied.

Three examples studied by the author should illustrate this point.

a. *The reaction of the iris to drugs.* Amphibian and mammalian iris react similarly to parasympathetic stimulants and depressants as well as to sympathomimetic drugs. The iris of the birds, however, shows no reaction to pilocarpine, atropine or adrenaline. However, it responds definitely to curare and veratrine. Pharmacological research thus reveals the same situation which morphological research does, i.e., the iris of the amphibians and mammals consist of smooth, the avian iris, however, of striated musculature. It further shows a fact which is not easily investigated by purely morphological methods i.e., the avian iris has no autonomic control, but is exclusively supplied by somatic motor fibers. (Phylogenetic implications?)

b. *Total removal of the pancreas* in mammals results in typical diabetes which, when not treated with insulin terminates fatally within a short time. Total removal of pancreas in birds, however, causes diabetes only for 6 to 8 days. After that period the blood sugar returns to the normal, the sugar disappears from the urine and the liver stores glycogen. The animals die apparently from digestive disorders and inanition.

The third example is described in the two following papers.

The reason for the introduction of comparative pharmacology is then two-fold. It furnishes additional data on animal structures and functions, and also it aids the human pharmacologist in understanding certain phenomena which may be explained or fully understood only on a comparative basis.

44. A NEW METHOD FOR COUNTING RED CELLS. Eric Ponder, Albert S. Gordon, and Max Dubin, New York University. (Introduced by Robert Chambers.) (Lantern; 10 min.)

The number of red cells per millimeter³ of blood is given by dividing the percentage volume by the mean volume of the individual red cell. The percentage volume can be found by a high speed haematocrite, and the mean individual cell volume by placing the cells in lecithin-treated plasma and measuring the mean volume diffractometrically. A little lecithin is added to the animal's plasma,

and to this is added a little of the animal's plasma; the red cells then become perfect spheres without change in volume. This volume can be found from the diffractometrically measured radius.

The results given by this method have been compared with those obtained by two skilled observers, each counting about 2000 cells by the haemacytometer method. The discrepancy between the figure obtained by the new method and the average of the two counts is rarely more than the discrepancy between the counts themselves. This applies to the blood of man, the rabbit, the ox, and the sheep.

The new method is very rapid, for as many as twenty counts can be done in 30 minutes.

By demonstration

45. SEXUAL CONDITIONS IN *TRITURUS VIRIDESCENS*. ARTIFICIAL HERMAPHRODITISM. (MALE HOSTS WITH OVARIAN GRAFTS). A. E. Adams, Mount Holyoke College.

Three groups of adult males (*Triturus viridescens*) were engrafted with ovaries from adult females: sixty-five received two ovaries and thirty one ovary in addition to their two testes; sixty-five received one ovary after one testis had been removed. The operations were performed at different times in the year and the animals were kept alive as long as possible, 101 surviving from 10 to 495 days. In eighty-one of these the grafts were attached, but they varied considerably in size and condition. Invariably some immature tissue was present. In many cases eggs with more or less yolk were found. Often traces of degenerating eggs occurred. Relatively few cases (fifteen) of influence of host by the graft were observed and this influence showed mainly in an enlargement of the rudimentary müllerian duct. In only five of these fifteen cases was the hypertrophy considerable and in four accompanied by evidence of secretory activity. The stimulation of the duct seems correlated with yolk-forming activity on the part of the oocytes of the grafted ovary. It is interesting also that in four of the fifteen cases, the grafts had been made in July and so contained few large yolked eggs. The relative difficulty of securing ovarian influence in male hosts (normal or unilateral castrates) contrasts with the effectiveness of ovarian grafts in bilaterally castrated males (Adams, '30). Other experiments indicate that the effectiveness of ovarian grafts in normal males can be increased by pituitary treatment (see abstract by Adams and Dudley).

46. TRANSFORMATION OF DERMAL PLICAE INTO TYMPANIC MEMBRANE. O. M. Helff, New York University.

Integumentary grafts including fully-differentiated dermal plicae structures were obtained from *R. palustris* frogs 2 to 3 weeks following larval involution and transplanted to the backs of non-metamorphosing *R. catesbeiana* larvae. Within 5 to 6 weeks complete macroscopic and histological regression of dermal plicae structures had occurred. The grafts were then retransplanted, heteroplastically, with the following results:

Grafts retransplanted to the backs and to the dermal plicae regions of metamorphosing *R. clamitans* larvae showed slight glandular development indicative of early dermal plicae formation within 6 to 7 weeks. Typical fully-differentiated dermal plicae structure was never obtained, the transplants usually tending to resemble normal integument.

Grafts retransplanted to the ear regions of metamorphosing *R. clamitans* and *R. catesbeiana* larvae developed into fully-differentiated tympanic membranes within 5 to 7 weeks.

It has thus been shown that transformation of a fully-differentiated structure (dermal plicae) into an entirely different tissue (tympanic membrane) is possible, following suitable double heteroplastic transplantation.

47. ACTION POTENTIALS IN THE NERVOUS SYSTEM OF THE CRAYFISH. C. Ladd Prosser, Harvard Medical School.

In the nervous system of the crayfish there are continual 'spontaneous' discharges of impulses which arise in the cells of the ganglia. These impulses are approximately one sigma in duration, 10 microvolts in apparent amplitude, and of characteristic wave form as recorded with a cathode ray oscillograph. They are present in deafferented ganglia. These spontaneous discharges are of lower frequency and of greater persistence than injury responses. Individual neurones discharge rhythmically. Rotation of activity keeps the total number of impulses relatively constant.

Against this background responses to photic, proprioceptive, and tactile stimulation appear as increases in number of impulses. The response to illumination of an eye consists of a rapid 'on' effect, slight maintained response, and an 'off' effect. Illumination of the last abdominal ganglion is followed in the nerve cord by a gradual increase in number of impulses, which persists for some time after stimulation ceases.

Operations on the central nervous system and study of responses in segmental nerves indicate that homolateral responses to proprioceptive and tactile stimulation are greater than contralateral responses. More of the tracts followed by these responses cross in the brain and in the last abdominal ganglion than in the thoracic ganglia, and fewer in the anterior abdominal ganglia. Most of the neurones in these tracts are unisegmental.

48. THE RESPIRATORY FUNCTION OF HEMOGLOBIN IN CERTAIN EMBRYOS. F. G. Hall, Duke University.

A spectroscopic method is described whereby oxygen dissociation curves can be made on small quantities of hemoglobin. The respiratory function of hemoglobin in foetal and maternal blood of the rabbit and goat has been studied. Foetal hemoglobin apparently becomes half saturation with oxygen at a lower tension than does maternal hemoglobin in all of the animals observed.

By title

49. GROWTH IN *DAPHNIA PULEX*. B. G. Anderson and L. J. Zupancic, Jr., Western Reserve University.

Daily observations on total length, carapace length, height, instar, and number of young released for eighty individually reared female *Daphnia pulex* from a single clone. Seventy-one were primiparous during the fifth instar and the remaining nine during the sixth. Of the former, forty-seven reached the twentieth instar. When the logarithm of the average total length for these forty-seven was plotted against age in instars a curve consisting of three relatively straight segments resulted. The intersection of the first segment with the second came between the fifth and sixth instars, and that of the second with the third fell on the tenth instar. It seems significant that the first intersection should come at sexual maturity and that the second should occur at the time when the greatest number of young were released. Growth was greatest during the pre-adult instars, decreased somewhat from the fifth to the tenth, and almost ceased after that period. The number of young produced, increased with each instar until the tenth (sixth adult), when an average of twenty-six young were released, and dropping gradually until the twentieth, when an average of sixteen were released.

50. DETERMINATION OF BROOD SIZE IN *MOINA MACROCOPA*. L. A. Brown, Transylvania College, and A. M. Banta, Brown University.

Neither the maximum nor minimum number of eggs to be produced in each instar of *Moina macrocopa* is determined until shortly before such eggs pass from the ovary to the brood chamber. Females reared under favorable food conditions produced an average of fifteen young each. Sister females produced an average of six young each when they were removed from the favorable food 15 hours before egg laying and starved for a 10-hour period. If this period of starvation was begun earlier or later than this, the number of eggs produced varied in a regular fashion between six and fifteen. Conversely a series of mothers reared continuously under poor food conditions averaged four young each. Sister females treated the same except given good food for a 10-hour period produced the largest brood (twelve young per mother) when this period of good food was initiated about 21 hours before the time of egg laying. Again, as in the first series, intermediate brood sizes varying in a regular way between the extremes of four and twelve resulted when the period of good food was begun earlier or later than 21 hours before egg laying.

The number of eggs reaching full ovarian development and passing to the brood chamber seems to depend on the amount of food available to the mother during a limited period before the end of each instar when the yolk is being deposited in the egg, and not to depend to any great extent on earlier food conditions.

51. OBSERVATIONS ON THE OVERWINTERING OF ADULT BEETLES. Ann H. Morgan and Janet F. Wilder, Mount Holyoke College.

Field observations of hibernating beetles were carried on from October 1 to May 1, 1932-1933. Identification of adults were made by Mr. C. W. Leng, Staten Island Institute of Arts and Science. Statements included in this preliminary report apply only to adults.

Of 461 hibernating adults observed (twenty-two species belonging to ten families), 171 were solitary, 254 were in aggregations of their own species, and 36 in aggregations of different species of beetles, sometimes of other arthropods also. Of the beetles observed the larger number (312) were on living trees, and the smaller (107) on logs and stumps.

Several species (Cerambycidae, Chrysomelidae, and Tenebrionidae) which have restricted food habits hibernated on or near their food supply. They were scattered over the bark, solitary individuals and small aggregations neighboring upon one another. Several species that were solitary at other seasons, some of them known to be carnivorous or else unrestricted feeders were many times found in aggregations containing several species of beetles and sometimes other arthropods (Carabidae, Coccinellidae, Lamypridae).

The depth and extent of the hibernating sleep varied with the species, most strikingly between species Elateridae and Carabidae. From October to May *Melanotus communis* (Elateridae) was always found completely dormant. On the other hand *Gynandropus hylacis* (Carabidae) was found active up to October 27th. From then to March 13th some individuals of this species were completely and others but incompletely dormant, but before May 1st all were apparently active. Records of other species of Carabidae furnished further indication of the incomplete dormancy of this family.

52. RESULTS OF FURTHER EFFORTS TO END THE DORMANCY PERIOD OF DAPHNIA LONGISPINA SEXUAL EGGS. Thelma R. Wood, Brown University and Carnegie Institution of Washington.

Previously reported attempts to end the dormancy period of *Cladocera* sexual eggs indicated that many *Moina macrocopa* eggs after being cast develop promptly (2 or more days) without drying. However, it was believed that *Daphnia longispina* sexual eggs must be dried before they hatch and that maximum hatching is induced by keeping them dry at room temperature 10 days to 3 months. Efforts to discover the minimum period of dry storage utilizable in hatching sexual eggs of *Daphnia longispina* revealed that the percentage of hatches varied inversely with the time the eggs remained dry (481 eggs). Furthermore, sexual eggs kept wet, but otherwise treated (by adding manure infusion) like those stored dry, hatched as well (33 per cent) as those dry 24 hours or less. In further analysis of the factors involved almost daily microscopic examination for nearly 4 months was made of 107 sexual eggs of *Daphnia longispina* about equally divided among three groups: one kept wet, one dry 4 days, and one dry a month. Transfer to slide for microscopic examination in itself apparently greatly facilitated hatching (65 per cent) of the eggs kept wet, only 11 per cent of which showed no development, although some (24 per cent) which began development died at various embryonic stages.

On the other hand, of those dried, slightly more than half showed no development. Apparently repeated aeration of wet eggs is the most successful expedient thus far tried for inducing hatching of sexual eggs of this species.

53. STUDIES ON THE WEIGHT-AREA RELATIONSHIPS OF FISHES. H. C. Burdick, State University of Iowa. (Introduced by J. H. Bodine.)

A method of measuring the body area of fishes was developed and measurements obtained from three species of fishes. Logarithms of the areas were then plotted against logarithms of the weights and a straight line was obtained for each of the three species. These data were analyzed according to the formula, $y = a + bx$. The log. of the area equals y , x equals the log. of the weight, a the intercept of the y axis, and b the slope of the curve. Constants (a and b) were determined by inspection from the straight lines mentioned above. It was observed that two species having similar body shapes had the same constants. One species studied had a body shape which was different from the other two and in this case the constants were decidedly different.

54. THE EFFECTS OF TEMPERATURE ON THE VISCOSITY OF ARBACIA EGG PROTOPLASM. Donald P. Costello, University of Pennsylvania. (Introduced by L. V. Heilburnn.)

The eggs of *Arbacia punctulata* were centrifuged at temperatures of 0° to 30°C., care being taken to keep the temperature of the eggs constant while being centrifuged. The relative viscosity of the protoplasm was measured by the centrifuging time necessary for the displacement of the yolk and oil granules to give a hyaline zone one-sixth the diameter of the egg. When relative viscosity is plotted against temperature, a smooth exponential curve is obtained, indicating a gradual increase in viscosity as the temperature is decreased. Near room temperature, there is no change in viscosity with temperature. For the twenty degree range from 24° to 4°C., the increase in viscosity is approximately threefold.

55. THE OSMOTIC BEHAVIOR OF RED CELLS. Eric Ponder and E. J. Robinson, New York University. (Introduced by Robert Chambers.)

Red cells obtained from defibrinated blood and suspended in hypotonic serum, also from defibrinated blood, swell in such a way as to show that they are more nearly 'perfect osmometers' ($R = 0.7$ to 1.0) than are cells obtained from oxalated blood and suspended in hypotonic oxalated plasma ($R = 0.5$ to 0.8). Cells in hypotonic solutions of monovalent electrolytes and of non-electrolytes such as glucose, are, on the other hand, very imperfect osmometers, irrespective of whether they are derived from defibrinated or from oxalated blood ($R = 0.3$ to 0.6). In such solutions, moreover, the 'critical volume' at which the cells begin to haemolyse is much smaller than it is in hypotonic plasma.

The perfection of the red cell as an osmometer and its cation impermeability are thus even more dependent on the nature of the medium bathing it than anyone has supposed, and the further the medium departs from being normal plasma, the farther does the erythrocyte seem to depart from being a perfect osmometer.

The same kind of results are obtained for the cells of man, the rabbit, the ox, and the sheep.

56. A METHOD FOR FOLLOWING OSMOTICALLY INDUCED VOLUME CHANGES IN MUSCLE.
Arthur K. Parpart, Princeton University. (Introduced by E. Newton Harvey.)

The amount of light transmitted by suspensions of cells (erythrocytes, leucocytes, unfertilized eggs of *Arbacia*) has previously been found to vary in relation to alterations of the cell volume, induced osmotically. This is also applicable to thin sheets of tissue. The abdominal muscles of frogs have been used, and the transmission measured by means of a photronic cell and a sensitive, fast period galvanometer at intervals as the muscle swells or shrinks. As the muscle shrinks the transmission increases; due, possibly, to an increased transmission between cells with slight change of transmission through the cells. The relation between transmission and the rate of water uptake by the tissue is determined from an initial calibration by the weighting method. Exosmosis and end-osmosis in hyper- and hypotonic Ringer solutions and the penetration of a number of non-electrolytes have been determined in this manner.

57. SPECIFIC DYNAMIC EFFECT OF FOOD ON FLUX EQUILIBRIUM OF CELL OXIDATION AND E.M.F. E. J. Lund, University of Texas.

Frogs were starved for 6 months, divided into two lots of twenty each. One lot was fed beef liver, the other kept as control. The skins from a fed and starved frog were isolated simultaneously. The rate of oxygen consumption and magnitude of E.M.F. of each were determined during the same 2-hour period. In all experiments in which the tests were made during the interval between 10 and 60 hours after feeding the velocity of oxidation and magnitude of E.M.F. of the skin were increased in the fed animals. The average increase of the E.M.F. and velocity of oxidation after feeding were respectively 83 per cent and 28 per cent. In the light of many other facts about the origin of inherent E.M.F. in the frog's skin, the results constitute additional evidence for the close linkage between E.M.F. and cell oxidation.

58. AN ELECTROMETRIC STUDY OF PERMEABILITY OF THE GRASSHOPPER EGG MEMBRANE (*MELANOPLUS DIFFERENTIALIS*). A. B. Taylor and Edgar John Boell, State University of Iowa. (Introduced by J. H. Bodine.)

A method has been devised by means of which the ionic permeability of the chitinous cuticle of the grasshopper egg (*Melanoplus differentialis*) may be studied electrometrically.

The grasshopper embryo is protected during development by two membranes. The outer of these, the chorion, can easily be removed. One end of the chitinous cuticle, the inner membrane, is cut off, and the embryo and yolk are gently forced out by squeezing on the other end with a small camel's-hair brush. Thus an envelope is obtained which may conveniently be mounted over the end of a capillary glass tube. The membrane is tied in place by means of a hair, and to insure a tight seal the junction of glass and cuticle is smeared with vaseline.

The tube is filled with salt solution, and the membrane dipped into an opening in a second tube through which a salt solution, varying in concentration or ionic content from the first, is flowing. By leading from the two solutions with calomel electrodes a potential difference may be read on a potentiometer.

The results obtained thus far are as follows:

1. For the salts tested (potassium chloride, sodium chloride, sodium bicarbonate, and sodium acetate) the membrane is more permeable to cations than to anions.
2. Insofar as can be determined, no significant difference exists in the ionic permeability of the micropyle and non-micropyle ends.
3. Potential difference usually does not reach an equilibrium value until several hours have elapsed.
4. For the concentrations of salt used, the potential differences observed, in the main, are considerably less than those which theoretically should be obtained across a membrane which is completely impermeable to anions. Thus the chitinous cuticle of the grasshopper egg resembles, to some extent, a leaky or porous collodion membrane.

59. STUDIES OF THE ELECTROMOTIVE FORCE OF BIOLOGICAL SYSTEMS: III. THE INFLUENCE OF LACK OF OXYGEN UPON RECOVERY OF POTENTIAL IN FROG SKIN. Edgar John Boell and A. B. Taylor, State University of Iowa. (Introduced by J. H. Bodine.)

The application of urethane in aerated Ringer's solution to frog skin causes a diminution of the normal equilibrium potential. The degree of depression of E.M.F. depends upon the concentration of urethane, and the particular member of the homologous series which is used.

The substitution of pure aerated Ringer for the urethane-Ringer's solution results in recovery of potential the magnitude of which is dependent upon, 1) the concentration of urethane which had previously been applied, and 2) the duration of its application. (Boell and Taylor, '33, in press.)

When oxygen-free Ringer (oxygen replaced by nitrogen) is brought into contact with the skin after urethanization, the recovery potential consists of only a small percentage of the normal.

Potential rises abruptly, and approximates the value of the normal equilibrium E.M.F. when oxygen-free solution is replaced by aerated Ringer. In some cases, the recovery potential is greater than the equilibrium P.D.; in others, it is somewhat less, but in every case, the recovery potential in aerated Ringer is greater than in nitrogenated Ringer.

A preliminary study shows that the addition of Ringer saturated with carbon monoxide to frog skin causes a depression of potential which, within limits, is completely reversible.

Thus it follows that the recovery of potential in frog skin is dependent upon the availability of oxygen and that the mechanism by which E.M.F. is produced is associated with the normal respiratory activity of the tissue.

60. THE FLATTENING OF MARINE EGGS UNDER THE INFLUENCE OF GRAVITY. E. Newton Harvey, Princeton University.

If egg cells are considered drops of a non-miscible liquid in water, resting on a plane surface, they should flatten, provided the tension (T) at their surface (whether elastic or surface tension) is sufficiently low, or the force gravity $\times$ difference in density between egg and medium, $g(d-d')$ is sufficiently great, or

their radius (r) is sufficiently large. Plasticity or elastic structure would act against flattening. Within limits the flattening, f , approximately varies as

$$r \propto \frac{\sqrt{g(d-d')}}{\sqrt{T}}$$

From Heydweiller's tables and equation it can be calculated that an egg (Arbacia) in sea water ($d-d'=0.06$), whose tension at the surface is 0.2 dynes/cm. should not flatten 10 per cent unless its radius is over 400 μ . Observation from the side shows that 'naked' eggs like Arbacia, Asterias, Echinarachnius, Ilyanassa, Crepidula plana, fornicata or convexa and Chaetopterus are either perfectly spherical, or, if irregular, remain so, without flattening. Buskcon canaliculatum eggs (1 mm. diameter) are of the consistency of putty and appear to flatten sufficiently to indicate a tension at the surface of less than 0.5 dyne/cm. Eggs with a definite chorion at the surface may be spherical (Phasecolosoma), slightly flattened when shed (Nereis), or disc-shaped when shed (Arenicola) due to conditions in the ovary. Such eggs merely fall on their flat side and their flattening has nothing to do with the action of gravity.

61. THE TENSILE STRENGTH OF A DEVELOPING EGG (ORTHOPTERA). Margarita Williams, State University of Iowa. (Introduced by J. H. Bodine.)

A study has been made of the tensile (?) strength of the egg of the grasshopper (*Melanoplus differentialis*) from the time of laying until hatching by measuring the weight necessary to break the egg under a standard set of physical conditions. During the first hour after laying a rapid increase in the weight (0 to 50 gm.) required to rupture the egg occurs. From this time to the ninth day of incubation at 25°C. the resistance of the egg remains unchanged. On the ninth day the values increase and continue through the eleventh day reaching an average of 250 gm. The egg maintains this resistance through diapause and blastokinesis. About 9 days after blastokinesis, values begin to decrease rapidly and continue so until the embryo is ready to emerge. At this stage the egg may be broken by a very slight pressure comparable to that shown by the newly laid egg.

Resistance of the egg up to the tenth day of incubation at 25°C. is perhaps due solely to the outer shell or chorion. The chitinous cuticle, laid down on the tenth day at 25°C., becomes the functional protective layer of the egg since removal of the chorion subsequent to this period produces no appreciable change in the egg's resistance to rupture. The marked decrease in the resistance of the egg before hatching suggests the presence and action of a 'hatching enzyme.'

62. STUDIES ON THE RESPIRATION OF FISHES. H. C. Burdick, State University of Iowa. (Introduced by J. H. Bodine.)

The oxygen consumption of five species of fishes were determined. The apparatus used consisted of a 'flowing system' slightly modified from that advocated by Keys ('30). Determinations of dissolved oxygen were made by the well-known Winkler method. Various sized animals of each species were used and their weight and body area determined. It was found that oxygen uptake of the fish expressed as cubic centimeters of oxygen per unit time and weight

varied inversely with the weight of the fish. When the oxygen uptake was expressed as cubic centimeters of oxygen per unit time and area the results obtained for any species were almost constant regardless of the size of the animals. On this basis it was possible to determine constant values characteristic for each species.

63. IRON CONTENT AND OXYGEN CONSUMPTION RATES IN DEVELOPING EMBRYOS (ORTHOPTERA). Joseph Hall Bodine and Julius E. Wolkin, State University of Iowa.

Quantitative determinations of the iron content of developing eggs and embryos of the grasshopper, *Melanoplus differentialis*, have been carried out by the method of Hart and Elvehjem. The iron content (0.125 per cent) is practically constant for the whole egg during its entire course of development. As the embryo develops, its iron content increases proportional to its mass. Conversely the iron content of the yolk decreases according to the increase in mass of the embryo. Increases in the iron content of pre- and post-diapause embryos follow increases in the rates of oxygen consumption. For diapause embryos the iron content remains constant while oxidation rates drop to a minimum value at constant temperatures. Apparently, rates of oxygen consumption for diapause embryos are not primarily functions of their iron content.

64. SOME EFFECTS OF CARBON DIOXIDE ON THE DEVELOPING GRASSHOPPER EMBRYO (*MELANOPLUS DIFFERENTIALIS*). Louisa M. Bradway, State University of Iowa. (Introduced by J. H. Bodine.)

The effects of different tensions of carbon dioxide have been determined on the 1) cellular activity of *Melanoplus differentialis* eggs at four embryological stages (shortly after deposition, 1 week, 2 weeks and post diapause or 3-week stages at 25°C.), 2) its degree of reversibility in causing the cessation of the heart beat of the embryo, and 3) the cytological picture in respect to cell division when the carbon dioxide has irreversibly stopped visible movement (heart beat). Increasing the carbon dioxide tension from 184 mm. mercury to 737 mm. mercury causes increase in retardation of development from 28 per cent to 100 per cent. Embryos show marked resistance to carbon dioxide as compared with similar results for other forms. Exposures of 62 hours and over to carbon dioxide saturated N/10,000 sodium bicarbonate solution cause an irreversible cessation of heart beat. With the irreversible cessation of heart beat there seems to be a decrease in the mitotic activity of the embryo.

65. CHANGES IN THE pH OF THE BLOOD OF THE JAPANESE BEETLE (*POPILLIA JAPONICA* NEWMAN) DURING METAMORPHOSIS. Daniel Ludwig, New York University.

Larvae of the Japanese beetle were collected in the field during the winter months and placed at 25°C. Nearly 250 readings on the pH of the blood were made on the third instar larva, the early prepupa, the late prepupa, and pupae of known ages.

During metamorphosis, there is a change in the pH of the blood from an average of 7.07 in the third instar larva to 6.79 in the late prepupa. Pupation is accompanied by a change to a more alkaline condition, the mean pH of the early pupa being 6.94. No significant changes were recorded during the pupal stage. The increase in acidity of the late prepupa is probably the result of the autolysis of larval tissue.

66. THE RELATION OF INTEGRITY OF THE CELL TO BACTERIAL LUMINESCENCE. Irvin M. Korr, Princeton University. (Introduced by E. N. Harvey.)

Numerous experiments on three species of luminous bacteria, two marine and one fresh-water form, indicate that luminescence cannot be obtained apart from intact bacteria. The bacteria were cytolysed in complete absence of oxygen by capryl alcohol, chloroform or by exposing the marine forms to very hypotonic solutions (dilute sea water). In other experiments they were ground up by a motor-driven glass rod revolving in a close-fitting glass tube. Although all experiments were carried out anaerobically (in vacuo, in hydrogen atmosphere, in presence of reducing substances, e.g., hydrosulphite, Pt plus hydrogen, or in combinations of these) to prevent oxidation of the photogenic substances, and even though, in many experiments, plenty of surface was provided by other, non-luminous bacteria or colloidal adsorbents, in none of them was luminescence obtained on aerating the suspension of broken-up bacteria. Attempts to demonstrate luciferin and luciferase, by methods used on Cypridina, in extracts of the bacteria prepared by the Lebedeff autolysis method, by adsorption on colloidal $\text{Fe}(\text{OH})_3$, kaolin, or Norit have proven negative. Although known to restore other oxidative activities to cytolysed cells, glutathione and methylene blue do not restore luminescence to cytolysed bacteria. Experiments in which sonic vibrations of high energy content are used to break up bacteria are now in progress.

67. THE EFFECT OF COPPER ON AMOEBA PROTOPLASM. C. A. Angerer, University of Pennsylvania. (Introduced by L. V. Heilbrunn.)

Copper has a striking effect on the protoplasmic viscosity of amoeba, even when present in extremely low concentration. Specimens of *Amoeba dubia* were immersed in various strengths of CuCl_2 solution from millionth molar to trillionth (10^{-12}) molar and the viscosity of the protoplasm (plasmasol) was determined from time to time with the centrifuge method. In all of these solutions there is a progressive increase in the viscosity of the protoplasm until it reaches seven and a half times its normal value. The increase in viscosity is more rapid in the more concentrated solutions, but the final value is the same in all solutions. After prolonged immersion in dilute copper solutions, the effect of the metal appears to wear off, and there is a tendency for the viscosity to return to lower values.

68. THE SIGNIFICANCE OF Ca TO MARINE FISHES ON INVADING FRESH WATER. C. M. Breder, Jr., New York Aquarium.

Field and laboratory studies have indicated that Ca has a protective value to marine teleosts against the effects of the lower tonicity of fresh water. A variety of marine species has successfully invaded Lake Forsyth, Andros Island, B. W. I., which has an average content of Ca of about 1.1 mm. and a Cl content of only about 13.6, compared with the nearby sea water with 13.5 Ca and 561.0 Cl.

Water synthesized according to an analysis of Lake Forsyth, enabled *Hippocampus hudsonius*, *Pomacentrus leucostictus* and *Centropristes striatus* to survive for about 1 week. Water saturated with CaCO_3 and CaSO_4 also supported the above, as well as *Stenotomus chrysops*, *Lutianus synagris*, *L. apodus*, *Anisotremus virginicus*, *Angelichthys ciliaris*, and *Abudefduf saxatilis*. The fresh water fishes, *Carassius auratus* and *Eupomotis gibbosus* lived satisfactorily with these marine species. Transfer from sea water was effected in about 3 days. Transfer in a similar time to untreated water proved fatal. The longest test (*L. apodus*) ran for 20 days.

Such fishes, when exposed to a slight mechanical jar, would gape their mouths and show nervous tremors. Sometimes death would ensue, but usually recovery occurred in a few hours. It is suggested that this may be a tetanus reaction from a small amount of Ca in solution. While evidently sufficient Ca for life was present, it would seem that a slight shock was sufficient to reveal the deleterious effect of the low concentration.

69. H-ION CONCENTRATION AS A FACTOR IN THE TOXICITY OF AMINES. Ruth B. Howland and Alan Bernstein, New York University and Johns Hopkins University.

A test has been made of the influence of pH changes on the toxicity of the amines to *Amoeba proteus*. Under the conditions of the experiment, the degree of toxicity of solutions of the hydrochlorides of methyl, ethyl, propyl and butyl amines varies uniformly with the H-ion concentration as follows: the toxicity at a pH of 7.8 > at a pH of 7.0 > at a pH of 6.4. In solutions of methylamine hydrochloride, the parallel between the increase in amount of undissociated base present and the decrease in lethal time is striking. In ethylamine solutions, this relationship holds in concentrations buffered to a pH of 6.4 and 7.0, but not for the solutions buffered to a pH of 7.8. In the case of propylamine, though all the experimental data are convincingly uniform, the divergence between calculated and actual toxicity concentrations is given more pronounced. The presence, therefore, of some other important factor or factors is clearly indicated.

The relative degree of toxicity of the first four primary amines may be expressed as follows: methylamine > ethylamine > butylamine > propylamine.

70. STIMULATION IN *FUNDULUS* BY HYDROCHLORIC, SULFURIC, AND NITRIC ACIDS AND BY THE CORRESPONDING SODIUM SALTS IN SEA WATER. James B. Allison and William H. Cole, Rutgers University.

The mineral acids, hydrochloric, sulfuric, and nitric, and the corresponding sodium salts have been tested as stimulating agents on *Fundulus heteroclitus* in a

sea water environment under constant experimental conditions. The pH of the acid solutions in sea water varied from 2.68 to 5.87. The reaction time (time in seconds for closure of the operculum) decreased in a predictable way as the hydrogen ion concentration increased. An analysis of the data demonstrates that equivalent concentrations of the acids enter into the equilibrium stoichiometrically. There was no apparent difference in the stimulating efficiency of the three acids due to a difference in the structure of the anion added to the system.

Concentration of the salt solutions as measured by the quantity of salt added to the sea water varied from 0.08 to 0.019 N. The pH of the solutions was the same as that of sea water. *Fundulus* reacted to these changes in its environment by a marked change in rate of movement of the operculum, sometimes by definite closure. A preliminary analysis of the data indicates that the effects of the three salts are essentially the same and that there is no marked change in the system due to the difference in the polarity to the anions resulting from dissociation. However, variation in the response to salts as contrasted to the response to acids points to a difference in the mechanism of reception.

71. STIMULATION BY THE DICARBOXYLIC ACIDS IN FRESH AND SALT WATER IN *FUNDULUS HETEROCILITUS*. Irwin W. Sizer, Rutgers University. (Introduced by William H. Cole.)

There is a parabolic relationship between the rate of reaction and the H^+ ion concentration when *Fundulus* is stimulated by the dicarboxylic acids, whether the environment be salt or fresh water. This means that the course of receptive processes which leads to stimulation is the same in both media, but differs quantitatively. In both cases rate of reaction varies with H^+ concentration according to the equation:

$$(\text{rate of reaction}) = K (H^+)^n$$

but the constants in the equation are very different.

The constant n shows how rapidly the rate of response changes with H^+ concentration. It might be considered a measure of the efficiency of the mechanism which relates reaction time to the (H^+) of a given acid and is characteristic of the receptive process. While the course of reaction is the same in salt and fresh water, the receptive processes are characterized by a more efficient catenary series of events in fresh water than in salt. For a given environment all dicarboxylic acids have the same value for n , i.e., the change in rate of reaction produced by a given change in equilibrium of the system is the same for all the acids.

K is characteristic of the acid in relationship to its environment. It might be considered a relative measure of the amount of energy brought to the semi-permeable membrane by a given acid. K increases exponentially with increase in length of carbon chain. Beyond succinic acid, however, further increase in the carbon chain brings about no change in K .

72. THE FREQUENCY AND AMPLITUDE OF LOCOMOTOR WAVES OF BLOW-FLY LARVAE AS RELATED TO LIGHT INTENSITY AND TEMPERATURE. John H. Welsh, Harvard University.

Larvae of *Lucilia* sp. were used in an analysis of some of the factors involved in determining the velocity of forward progression. Both light intensity and temperature were found to influence, to a very considerable degree, the speed of creeping. Rates of progression for each individual were determined over a range of light intensities from 1.2 to 1690 foot candles, at two different temperatures. At the same time the number of muscular waves were counted and the average frequency and amplitude of wave, at a given intensity of illumination, and a given temperature, then calculated.

At a constant temperature the velocity of progression increases with increasing light intensity over a very wide range, and a plot of velocity against $\log I$ yields a smooth curve. Both the frequency and amplitude of locomotor waves increase as the velocity increases but while amplitude plotted against $\log I$ yields a curve similar to the velocity curve, the frequency, plotted in a similar manner, yields a straight line.

The speed of progression increases with increases in temperature, and likewise the frequency of locomotor waves, but the amplitude of these waves decreases.

73. FACTORS INFLUENCING THE SPAWNING OF *OSTREA GIGAS*. C. R. Elsey, Pacific Biological Station. (Introduced by T. C. Nelson.)

The Japanese oyster, *Ostrea gigas* Thunberg, on the western coast of Canada, usually develops spawn in regular annual sequence, attaining spawning condition in July. Since water temperatures high enough to promote spawning independently are rarely attained at stages of the tide when other factors are suitable, natural spawning is erratic, failing entirely in some seasons and occurring too late in others to permit of larval development.

Early spawning in spite of unfavorable natural conditions can be effected by stimulation with sexual products. In 1932 and 1933, the former season characterized by late natural spawning and the latter by complete absence of it, many oysters were made to spawn in July and early August by experimental stimulation. In both seasons extensive spatting occurred. In 1933 ten isolated groups of oysters in Ladysmith Harbour, comprising in all over 5,000,000 individuals were caused to spawn by groups in the period between July 23rd and August 14. The initial response to stimulation, applied in each case periodically throughout a tidal phase, occurred shortly before high slack tide, with temperatures rapidly falling. Spawning commenced at 23°C., in three instances, at 21.5°C., in five, and at 21°C., in two. Females spawned down to 20°C., and males to 19°C. The stimulating effect was transmitted along the paths of the water currents resulting in lanes of spawning distinguishable by their milk-like appearance. Complete discharge of sexual products of individual oysters was accomplished usually in less than 1 hour.

74. EVIDENCE FOR A SYMPATHETIC INNERVATION OF THE TELEOST HEART. Floyd J. Brinley, North Dakota State College.

A study was made on the effect of nicotine, which in dilute solutions is known to stimulate the sympathetic system of higher animals, on the cardiac rhythm of *Fundulus* embryos to determine if the cardio-regulator nerves contain accelerator fibers. The nicotine solution was diluted with isotonic salt solution to give concentrations varying from one part nicotine in 500 to one part in 5000 parts salt solution. *Fundulus* embryos varying in age from 4 days until hatching were freed of the chorion and immersed in the drug. The cardiac rhythm was determined by counting the number of beats per minute. The results obtained show that the younger embryos from 4 to 8 days after fertilization react differently to nicotine than the older ones. The acceleration in rate of the heart beat of the older embryos after immersion in the dilute solution of nicotine is considered evidence for a sympathetic innervation, which occurs from 8 to 10 days after fertilization.

75. RECOVERY OF NON-DEVELOPING MUD WASP LARVAE AFTER IRRADIATION WITH X-RAYS. J. H. Bodine and T. C. Evans, State University of Iowa.

It has been shown in earlier reports that low intensities of x-rays accelerate the rate of oxygen consumption and development of the mud wasp larvae (*Sceliphron caementarium*) and that intensities of approximately 600 R. units temporarily retard development and oxygen consumption.

If larvae in diapause are irradiated with similar intensities the effects will have apparently disappeared by the time development takes place.

If larvae are placed at a sub-developmental temperature for a few weeks following irradiation the effect will have apparently disappeared when the organism is later allowed to develop at the normal temperature (28°C.).

It may then be considered that at least a part of the effect of x-ray irradiation is on the physiological processes then active rather than directly on the cell potentialities.

76. X-IRRADIATION OF THE OVARIES OF GUINEA PIGS AND ITS EFFECT ON SUBSEQUENT PREGNANCIES. Ida T. Genther, Children's Hospital Research Foundation and University of Cincinnati.

Ovaries of sexually mature guinea pigs were x-rayed with a minimum sterilization dose or two-thirds of this amount. Oestrous cycles continued, though not always normally. In general, the instances of failure to mate, infertile matings, and abortions in event of conception, increased with greater ovarian injury and subsequent more marked cyclic disturbances. The greater incidence of pregnancy occurred where cycles were only temporarily inhibited, then normal, and ovaries were functioning normally but had few follicles. No conceptions occurred where cycles were irregular with atypical, indefinite oestrous openings, where ovaries contained almost no follicles but were still functioning normally. None occurred after the ovarian stroma was replaced by 'interstitial gland,' when cycles were very irregular with prolonged, intense oestrous periods; a few occurred at the apparent normal cycles immediately following treatment, before the interstitial gland was established, but infertile matings and abortions were more numerous than successful pregnancies.

Irradiation in early pregnancy caused abortion soon after, before ovarian injury was very marked.

Immature animals were unable to survive the full sterilization dose, thus no interstitial gland was produced. Smaller doses caused follicular destruction in varying degrees. At maturity, cycles were regular where ovaries were practically normal, irregular and atypical where ovaries had few follicles but were still functioning normally. A few pregnancies resulted, as in the above mature animals with similar histories.

77. INHIBITION OF REGENERATION IN THE ADULT NEWT BY X-RADIATION. Pressley L. Crummy, University of Pittsburgh. (Introduced by H. H. Collins.)

When the tip of the amputated tail of the red-spotted newt, *Triturus viridescens*, is exposed to an x-ray dosage of eighty-nine 'r' units, a slight but temporary acceleration of the rate of growth is brought about. This is demonstrated by the fact that, 60 days after exposure to the above dosage, the amount of regeneration in the experimental group was slightly greater than that in the control group. One hundred and twenty days after exposure, however, the amount of regeneration was equal in the two groups.

A dosage of 450 'r' units brought about a complete cessation of growth for as long as 60 days after exposure. Between 60 and 120 days after treatment there was an irregular renewal of regenerative processes resulting in a bending and twisting of the tip of the tail but without a noticeable increase in length. In contrast to these effects, a dosage of 1800 'r' results in complete cessation of regeneration for 12 months, at which time the experiment was discontinued.

The results cited above were obtained after having exposed the experimental animals to the x-rays immediately after amputation of the tail. In another series, it was found that the characteristic twisting and bending of the regenerating tip of the tail might be induced by a dosage of 1800 'r,' when the exposure was made 60 days after amputation.

78. THE MECHANISM OF TANDEM BEHAVIOR FOLLOWING THE COLONIZING FLIGHT IN TERMITES. Alfred E. Emerson, University of Chicago.

Following flight, female termites attract males by odor. When the male touches the female, she lowers her abdomen and is followed in tandem. Males also follow the severed tip of the female abdomen, the tips of forceps wiped in alcohol, or other males, if once attracted by the female. No modification of the tandem behavior occurs when the peripheral antennal segments are removed, providing ten segments remain in each antenna. Abnormal behavior always occurs when less than eight segments are left on one antenna. Sometimes abnormal tandem action results when nine segments are intact in both antennae. Males run forward on the right side of the female when the left antenna has less than eight segments (sometimes when it has nine segments) and the right antenna has ten plus segments. Males run forward on the left side of the female when the right antenna has less than eight segments (sometimes when it has nine segments) and the left antenna has ten plus segments. It is postulated that the tandem action follows the symmetrical tactile stimulation of the eighth to tenth segments. Greater flexibility occurs in this region. Behavior modification

follows removal of these segments in both *Reticulitermes arenicola* having seventeen segments and in *Reticulitermes flavipes* having eighteen segments. The terminal segments are homologous, division occurring in the third. The reaction is thus not due to specific sense organs in a particular segment, but rather to tactile stimulus of a comparatively flexible region.

79. EXPERIMENTAL MODIFICATION OF THE SEASONAL SEXUAL CYCLE OF THE ENGLISH SPARROW, *PASSEER DOMESTICUS*. Arthur Kirschbaum, University of Minnesota. (Introduced by A. R. Ringoen.)

Male English sparrows exhibit minimum testis size during October, November, and December. The spermatogenic inactivity of the winter period is followed by active sperm production during the latter part of March.

Increased daily light ration (6 to 7 hours per day from a 60 watt incandescent bulb for 6 weeks) during October, November, and December induces increase in testis size in both adult and juvenal sparrows. The testes of light treated birds are at full spermatogenic activity.

High indoor temperatures (12° to 23°C.) during the time of the experiments in increased daily light ration produce no gonadal change in control birds.

The experimental results on reduced daily light ration during the spring suggest that light stimulus, afforded by normally lengthening days, is a factor in causing sexual maturity at this time of the year. Reduction in daily light ration does not invariably result in complete suppression of testis activity, indicating that other factors are operative.

During testicular enlargement, whether normal in the spring, or experimental in November and December, the juvenal male acquires a black beak. If testis activity is suppressed in the spring, the juvenal retains a light-colored beak.

80. ON THE GENESIS OF ORAL INCUBATION IN FISHES. C. M. Breder, Jr., New York Aquarium.

At least five unrelated groups of fishes contain members which have been unequivocally shown to carry their eggs in their mouths through incubation and hatching: Osteoglossidae, Scleropages and (*Arapaima*?); Nematognathi (*Arridae*, all genera?); Osphromenidae, *Betta pugnax* (only species?), *Apogonidae* (all genera?); *Cichlidae* (several genera, e.g., *Tilapia* and *Haplochromis*). Laboratory studies on the orally incubating *Betta pugnax*, *Tilapia heudelotii* and *Haplochromis strigigena*, and the nest-building relatives of oral incubators *Ameiurus nebulosus*, *Betta splendens*, *Cichlasoma nigrofasciata*, *Aequidens latifrons*, and field studies on *A. nebulosus*, *C. maculicauda* and *A. coeruleopunctatus* show clear indications of the habits developed. The former all display distinct traces of the no longer employed nesting habits, and the latter prophetic behavior. All take their eggs in the mouth at some time. In no case does evident structural modification of the mouth accompany this change in habit. Ariids, Osphromenids and Cichlids, which carry their eggs, all appear to live under conditions unsatisfactory for nesting. Nest-building fishes of other groups, not having orally incubating members, have not been shown to take their eggs in the buccal cavity as a regular feature of the reproductive behavior.

The genesis of oral incubation thus appears to be lodged primarily in an inhibition of the general predisposition of fishes to eat their own eggs; secondarily, in some type of nesting habit involving the need of taking the eggs in the mouth, and tertiarily, in some shift in the external environment which prevents satisfactory nesting.

MORPHOLOGY

Read

81. POLYDACTYLISM IN MICE. J. M. Murray, R. B. Jackson Memorial Laboratory. (Introduced by C. V. Green.) (10 min.)

First observed in the twentieth generation of inbreeding, a six-toed condition has occurred on one or both, usually only one, of the hind feet among the animals in a strain of control mice. The extra toe has been observed on over 300 individuals in this strain during the last 3 years.

A wide range of variation is found in the degree of expression of the character. The duplication of bones varies between the extreme condition where the articulation of the extra digit is on the tarsal bone and that of a mere exostosis on the distal phalanx. In all but three cases so far observed the duplication has been associated with the first toe. The character is readily observed at birth.

Inheritance of the character is not simple mendelian in nature. Breeding records show a much higher proportion of six-toed progeny resulting from six-toed by six-toed matings than from six-toed by normal, or normal by normal matings among closely related animals.

82. THE MECHANISM OF DIFFERENTIATION OF CHELAE IN SOME CRUSTACEA. Hugh H. Darby, Bartol Research Foundation. (Introduced by J. H. McGregor.) (Lantern; 15 min.)

In 1901 Przibram showed the interesting phenomenon of reversal of asymmetry in *Alpheus*. When the large chela of this organism is removed it remodels the existing small chela into a large one at the next molt, and regenerates a small one in the place of the large one. It was also shown that if both chelae were removed at the same time that they returned to their original positions. Experiments in which the small chela was removed before the large one with various intervals of time showed that if the original small side obtained a sufficient start the large chela would grow back on that side. Based on the above experiments it was possible to investigate the nature of the mechanism responsible for large chela formation and the nature of the conditions necessary for a shift from side to side. It was found that a definite substance is produced but only in small amounts. It is capable of divisibility in that an organism with both large chelae was produced. Many more animals with both small chelae were produced than with both large chelae. The metabolic state seemed responsible for the amount of production of the substance making large chelae. The metabolic rate was lowered with gamma radiation from radium and a greater percentage of equal small chelae was obtained than in the controls.

83. FLUCTUATIONS IN THE COMPOSITION AND STRUCTURE OF BONE AND THEIR BEARING UPON ENDOCHONDRAL OSSIFICATION. Samuel E. Pond, Marine Biological Laboratory, Woods Hole. (Introduced by W. H. Cole.) (Lantern; 12 min.)

Analyses of fresh cortical and articular bone from normal and injured regions were considered in relation to 1) age or growth, 2) artificially impaired circulation, and 3) subperiosteal injury (or fracture) and subsequent healing. Alterations in the organic and in the inorganic fractions were determined by means of chemical and physical analyses. The direction and order of changes were by ratios: relating calcium to magnesium; phosphate to carbonate; fat (and lipin) to protein; fat to acid-soluble fraction; acid-soluble to protein; and total organic to total inorganic. Four animal series are considered which have previously been analyzed with respect to the variations in whole bones paralleling age. The evidence of direct, dependent relationship between inorganic fractions (bone-solid) and the circulating fluids is scanty. Changes in the bone-solid do not run parallel with changes in the organic fractions accompanying age or growth. The alterations in the solid phases do reflect changes in the circulating fluids and follow, markedly, impairment of circulation. These are apparently selective, and indicate a second-order relationship. Such evidence taken together with histological studies of record point toward a revision of certain current ideas of bone formation. The major points are emphasized to facilitate further research concerning the general physiology of ossification. Progressive changes in normal bone, as indicated by physical and chemical analyses, are given in a step-step manner, together with a description of a bone model. The histological methods employed in these studies, associated with the chemical and physical procedures, will be published separately.

84. ANALYSIS OF THE REGENERATIVE PROCESSES IN NEMERTEANS. W. R. Coe, Yale University. (Lantern; 12 min.)

In posterior regeneration the new tissues are laid down by undifferentiated reserve cells which migrate posteriorly from their original positions in the parenchyma. They are then differentiated and incorporated into the old systems. In the regeneration of a new head from a fragment of the body a true blastema is formed. The new epidermis is derived from the old, but the principal mass of the blastema consists of an undifferentiated mesenchyme formed by anterior migration of pluripotent reserve cells. Localized differentiations of these cells constitute the primordia of the new brain and the other organs, with the exception of mouth, foregut epithelium and cerebral sense organs, which are derived by invaginations of the new epidermis.

The great differences in the capacity for anterior regeneration in closely related species appear to be correlated with a corresponding polarization in the movements of these reserve, or regenerative, cells. Bipolarity of migration, associated with the organization center, is in most species limited to the region at the anterior ends of the nerve cords, but in a few species this bipolarity extends the entire length of the body. Migration of epidermal cells in wound healing and an extensive reorganization of the original tissues occur in the absence of the nerve cord, but a blastema is not formed. Removing the nerve cords evidently inhibits the organization center, perhaps by removing at the same time reserve cells essential for complete regeneration or the necessary stimulus for their movements.

85. THE EFFECTS OF X-RAYS ON ANTERIOR REGENERATION IN LUMBRICULUS INCONSTANS. Clarence D. Turner, University of Georgia. (Introduced by J. W. Nuttycombe.) (5 min.)

A head consisting of seven segments is normally regenerated at any level of the body except at the extreme posterior end. Five days after the removal of twenty to twenty-five anterior segments, septa, blood vessels, setae, mouth, cerebral ganglia, circumpharyngeal connectives and nerve cord have been restored. Within 15 days the newly formed segments have attained adult size, and are complete except for the pigmented bands which do not appear until several weeks later.

The nervous elements are formed by the inward migration of epidermal cells. The dorsal and ventral blood vessels, setigerous muscles and septa differentiate from neoblasts. The setal follicles arise from segmental aggregations of epidermal cells. The origin of the body wall muscles has not been determined, due to the difficulty of distinguishing between smaller neoblasts and the large epidermal cells present in the body cavity. The pharynx is restored by mitotic proliferation in that layer, a stomodaeal invagination being formed as in embryonic development.

Anterior regeneration is completely inhibited by exposure to x-radiations (approximately 7500 r units). A small knob is formed at the cut surface by the rearrangement of the old body tissues. Irradiated worms have been kept alive for 60 days without regeneration. There is little, if any, mitotic proliferation in the epidermal and endodermal layers. An oral cavity is not formed. The quiescent neoblasts are reduced in numbers and metamorphosing stages are entirely absent.

86. INFLUENCE OF SULFHYDRYL AND SULFOXIDE ON CHROMOSOME AND ASTER DIMENSIONS IN REGENERATING TISSUES OF CLYMENELLA TORQUATA. Frederick S. Hammett, Marine Experimental Station of Lankenau Hospital Research Institute. (10 min.)

When sulfhydryl is added to cultures in which the marine worm *Clymenella torquata* is regenerating a posterior end there results not only an increase in the number of mitotic figures but also an increase in chromosome width and a tendency to increase in chromosome length and aster spread of the dividing cells. When a partially oxidized derivative of the SH group is added in the form of sulfoxide the change from the usual is in the opposite direction; i.e., the chromosomes are thinner and shorter and the aster spread is less. These results indicate a direct influence of the chemical groups found regulatory of growth by increase in cell number on the processes of cell division.

By demonstration

87. PRESENCE OF TYROSINASE IN THE SKIN OF THE NEWT, *TRITURUS VIRIDESCENS*. Kenneth L. Kelley, University of Pittsburgh. (Introduced by H. H. Collins.)

Injections with tyrosine solutions, both subcutaneously and interperitoneally, gave inconstant results in *Triturus viridescens*. However, immersing living animals in a 1:1000 solution of tyrosine caused blackening within 12 hours. The animals were then placed in water. The black color persisted until successive molting removed the epithelial layers.

Molting began in from 16 to 24 hours. One individual molted three times within 48 hours. Normal coloration reappeared after molting. Upon microscopic examination of the shed molts, small melanic granules were seen to be thickly distributed in the periphery of all the epithelial cells. Observation of the living animals with the ultra-opaque microscope showed fine melanic granules distributed intercellularly as well as peripherally in the epithelial cells.

Re-immersion in tyrosine solution caused a second darkening of epidermis within 12 hours. Control animals placed in the same solution were less dark than those from the previous experiment.

88. REGENERATION IN *THYONE BRIAREUS* L. FOLLOWING INDUCED EVISCERATION.
Frank R. Kille, University of Chicago. (Introduced by B. H. Willier.)

Autotomy of the stomach-intestine and lantern structures was uniformly induced by chemical (NH_4OH) or electrical stimulation. Ninety-six per cent of the animals lived and regenerated the lost parts. The first morphological indication of the regenerating alimentary tract takes the form of discontinuous, rod-like thickenings of the mesentery edge. These independent thickenings are best studied 4 to 8 days after evisceration. They occur with greatest frequency: 1) adjacent to the cloaca, 2) adjacent to the healed anterior end of the body, and 3) in three intermediate regions of the mesentery. Eventually these thickenings become continuous, establishing the rudiment of the stomach-intestine. Short sections of definite gut lumen are found 6 to 8 days after evisceration in at least three independent regions of the regenerating alimentary tract, namely, 1) in the lantern anlage, 2) just anterior to the gonad, and 3) continuous with the epithelium of the cloaca. Of these three sections, only the last is in connection with a remnant of the original gut tract. There are several indications that the epithelium lining the lumen in the other two regions arises from cells in the coelomic epithelium. A single continuous lumen may be established in a regeneration of 12 days. The lantern and associated structures originate from contributions of the body wall and the anterior extremities of the ambulacral structures. A posterior half of an eviscerated or uneviscerated *Thyone* will regenerate all missing structures. The regeneration is comparable to that occurring within an entire animal except that reconstitution of the lantern is delayed.

By title

89. FURTHER OBSERVATIONS ON SUPERNUMERARY STRUCTURES INDUCED IN PLANARIANS BY CAUTERY. E. D. Goldsmith, Harvard University. (Introduced by H. W. Rand.)

It has been previously demonstrated (Goldsmith, *Anat. Rec.*, '32) that 'head-like' outgrowths may be produced in planarians by use of a platinum electro-cautery needle.

Further experiments, in which the needle has been heated but slightly, have been performed and animals have been observed for 6 to 12 months after the operation. The types of structures arising fall into the following classes:

1. Bulges which persist as such without further differentiation.

2. Bulges which develop into outgrowths which *a*) may pinch off a distal portion and the proximal portion may be absorbed, or else give rise to a new distal region; *b*) slowly shift their position so that they come to lie more and more anteriorly, and finally appear as if they were one of the members of a double head resulting from fusion of two heads produced by splitting the anterior region of a planarian in the midline; *c*) gradually become more definitely headlike until they are indistinguishable from a typical head.

In one case, 35 days elapsed before the outgrowth assumed a headlike form. This structure, exhibiting autonomous movement and attempting to move in a direction contrary to that of the host, separated from the host, leaving a short stump. A new typical head regenerated in 5 days.

To date, no secondary pharynges have been observed.

90. VARIATIONS IN THE HUMAN HYOID BONE. H. H. Collins and D. L. Platt, University of Pittsburgh.

The present study is based upon a series of nineteen abnormal human hyoids collected by the junior author.

The body varies greatly in ratio of width to length (42 per cent to 64 per cent), as well as in thickness and development of the transverse horizontal and median vertical ridges. The 'entoglossal process' may be absent or strongly developed. The major cornua may be markedly asymmetrical in size, form and position. The most striking abnormalities however are found in the lesser cornua, in which the following conditions have been observed: 1) entirely absent on both sides; 2) absent on one side but present as a small tubercle 4 or 5 mm. long on the opposite side; 3) abnormally long slender spines about half the length of the greater cornua. The most extreme variation presented by the series is presented by a specimen in which the lesser cornu of the right side is 50 mm. in length, approximately five times the normal length. The corresponding greater cornu has a length of 34 mm. The lesser cornu of the opposite side is also abnormally long, but is only 17 mm. in length.

91. DIFFRACTION SPECTRA PRODUCED BY STRIATED MUSCLE: FRESH AND INTACT, AND FIXED AND SECTIONED. Alexander Sandow and Benjamin P. Sonnenblick, New York University. (Introduced by Robert Chambers.)

A freshly excised intact sartorius of *Rana pipiens* acts as a transmission grating. The striae distance determined from measurements of the relative positions of the various orders of spectra is 2.5μ , in agreement with the microscopically determined value.

The higher the order of a spectrum formed by the muscle the smaller the intensity. Since the light and dark striae are of nearly equal width, this order of intensities cannot be explained on the assumption that the entire muscle acts as a single grating. It was therefore of interest to investigate the spectra produced by a single layer of fibers. For this purpose longitudinal sections of a sartorius fixed at normal length were prepared. The unstained sections produced remarkably good spectra, resolving in the first order under a dispersion of about $1000\text{ A}^\circ/\text{cm.}$, the yellow, green, blue and violet lines of mercury are light. The

even orders are now much less intense than the odd, thus showing, despite the irregularity in alignment of the striae and the lack of perfect opacity in the dark bands, that this single muscle grating with its nearly equally wide dark and light bands behaves quasi-ideally. The fact that the entire muscle does not give the alternating intensities can now be explained by the assumption that it consists of a set of superimposed gratings which cause successive diffractions of the original light beam.

This work is being undertaken in an attempt to study striae structure and behavior by the diffractometric method. The present work gives no evidence of the existence of Hensen's line or Krause's membrane in frog sartorius. Other experiments, in progress, are designed to follow changes in striae behavior during various sorts of contractions. The results will appear elsewhere.

92. BILATERAL AND UNILATERAL DEVELOPMENT OF OVARIES IN RAPTORIAL BIRDS.

F. L. Fitzpatrick, Columbia University. (Introduced by Secretary of Section F.)

The examination of adult female hawks indicates that bilateral development of ovaries persists in certain species. Apparently this condition is typical in some species, and less common or rare in others. The writer has found bilateral development (ovaries) in two specimens of Cooper's hawk (*Accipiter cooperi*), and one specimen of the eastern red-tailed hawk (*Buteo b. borealis*), although in the latter case the right ovary consisted of only twenty-three follicles. Snyder has reported cases of bilateral ovaries in the marsh hawk (*Circus hudsonius*), the sharp-shinned hawk (*Accipiter velox*), the eastern red-tailed hawk, the broad-winged hawk (*B. platypterus*), and the sparrow hawk (*Falco sparverius*). Kummerlöwe reports bilateral ovaries in young females of *Accipiter gentilis* and *Falco tinnunculus*, and in an adult female of *Falco peregrinus*.

In contrast, three adult females of the eastern red-tailed hawk examined by the writer had only left ovaries. The same was true of two female northern red-shouldered hawks (*B. l. lineatus*), and one specimen of the turkey vulture (*Cathartes aura septentrionalis*). Nine female owls exhibited unilateral development of ovaries. These included two barred owls (*Strix v. varia*), two great horned owls (*Bubo v. virginianus*), two snowy owls (*Nyctea nyctea*), one western horned owl (*B. v. pallescens*), one screech owl (*Otis asio*), and one Richardson's owl (*Cryptoglaux funerea richardsoni*). The evidence suggests that unilateral ovaries are characteristic of adult female owls, and perhaps of some species of hawks, although in the latter case individual variation is probable.

93. THE HYPOPHYSIS CEREBRI OF THE BAT, *MYOTIS LUCIFUGUS LUCIFUGUS*. Mary J. Guthrie, University of Missouri.

The hypophysis of the bat is approximately 2 mm. across and 1 mm. in antero-posterior diameter and lies flattened against the tuber cinereum. While the pars nervosa and pars buccalis are adjacent to one another there is no overgrowth, and the two regions can be separated with ease. The solid pars nervosa occupies the more dorsal and posterior position and is connected with the brain by a hollow infundibular stalk which is compressed by the pars distalis or glandular anterior lobe. The pars buccalis is differentiated into a conspicuous pars distalis

and a narrow pars intermedia; no pars tuberalis has been identified. In many specimens the original lumen of the buccal evagination is completely obliterated by the juxtaposition of buccalis and intermedia. However, in about 25 per cent of the specimens examined the lumen can be identified, in some part of its original extent, either as a very narrow empty residual cleft which may result from fixation where no cross cellular growth has attached the adjacent distalis and intermedia, or as one or more vesicles containing colloid. These colloid vesicles are expanded into the pars intermedia but always have an anterior border lined with cells of the pars distalis. Some of these cells are usually ciliated, and sometimes the ciliated areas are extensive. From the anterior borders of such residual clefts ciliated colloid vesicles may arise; these lie completely in the pars distalis. These remnants of the cavity of Rathke's pocket are found in both young and old bats.

94. INTEGUMENTARY REGENERATION AND MITOGENETIC RAYS. O. H. Helff, New York University.

The regenerative rate of tail-fin wounds on larvae maintained in quartz and glass-bottomed vessels over degenerating tail muscle and intestines was compared. Sixty-three hundred and thirty-six wounds made on *R. catesbeiana*, *R. palustris*, and *R. clamitans* were thus observed. No increased regenerative rate was recorded for wounds on larvae in quartz-bottomed vessels.

R. catesbeiana and *R. clamitans* larvae with integumentary wounds on the tail were placed in a specially constructed dish in groups of sixteen, so that the wound areas approximated one another. Control dishes separated wound areas with glass partitions. Eight hundred and seventy wounds were made and observed. No increased regenerative rate was recorded for the experimental animals.

Tail-fin regeneration in small and large homologous triangular wounds and in narrow and wide angled notch-shaped and triangular wounds was determined. Three hundred and twenty cases were studied. Wound perimeter does not influence regenerative rate, while linear rate of regeneration is dependent on the angle (area) to be regenerated.

Over 600 tail-fin wounds were insulated with cotton thread against possible 'mitogenetic ray' effects. The pronounced 'shearing' action of the thread made comparative regenerative studies impossible.

The above results constitute a repetition of Blacher et al. work in which they obtained largely positive results, which they interpret as due to the effects of 'mitogenetic' radiation. The results of the present paper do not confirm those of Blacher et al. The writer has obtained no data indicating either the presence or physiological effect of mitogenetic rays under the conditions of the experiments.

95. EFFECT OF RINGER'S SOLUTION ON TAIL REGENERATION IN THE TADPOLE OF *RANA PALUSTRIS*. Leonard P. Sayles, College of the City of New York. (Introduced by William H. Cole.)

Tadpoles of *Rana palustris* regenerating new tails produce, in general, less new tissue when kept in an approximately isotonic frog Ringer solution than when allowed to remain in ordinary fresh water.

The regeneration of the caudal membrane is frequently affected by isotonic solution. Occasionally the bud of new tissue consists merely of the main skeletal axis without any membrane. In some other cases a much reduced or irregular membrane is formed.

96. RECONSTITUTION OF ANURAN TAIL INTEGUMENT OVER WOUND AREAS. F. W. Dunihue, New York University. (Introduced by O. M. Helff.)

Rectangular pieces of integument, 8 sq.mm. in area, were removed from a dorso-ventral axis of the tail on non-metamorphosing *Rana catesbeiana* tadpoles. The resulting wound areas were located in the dorsal and ventral finny regions and in the intermediate median zone overlying the tail musculature. Individuals so treated were fixed at successive 3-day intervals for subsequent histological examination.

Median areas were found to undergo complete integumentary regeneration before either the dorsal or ventral wound areas, while little or no difference was noted in the incidence or rate of regeneration between the latter two types of regional wounds.

Other similar series of experiments were made involving median wounds at various anterior-posterior levels. Histological reconstitution of integument was completed earlier in anterior as compared with more posterior wound regions.

A median-dorso-ventral and an anterior-posterior regenerative gradient have therefore been established for complete integumentary regeneration of wound areas on the tail.

97. THE FORMATION OF NERVE ENDINGS IN THE SUCKERS OF REGENERATED ARMS OF THE CEPHALOPOD *OCTOPUS VULGARIS* LAM. Raoul M. May, Collège de France and Institut Pasteur.

Regenerated arms of *Octopus vulgaris* Lam. were impregnated by a special Cajal method for their nervous system. The suckers are formed at the same time as the central nerve axis. The terminal suckers, blastematous, are not innervated. The suckers which are present midway along the regenerated arm, also blastematous, have attracted nerve endings which ramify in their acetabulum. The suckers at the base of the regenerated arm, well differentiated, are completely innervated in their infundibulum as well as in their acetabulum. The suckers thus attract the nerve fibrils which are to innervate them. This type of innervation falls in line with Cajal's theory of neurotropism.

98. A REGENERATIVE GRADIENT IN PARTIALLY HISTOLYZED ANURAN TAIL SKIN. F. W. Dunihue, New York University. (Introduced by O. M. Helff.)

Previous work by the writer had shown that the incidence of histolysis in integument from the dorsal and ventral finny portions and the intermediate median region of the anuran tail, when autotransplanted to the back, occurred in the sequence: median, ventral, dorsal. The possible existence of a corresponding regenerative gradient was investigated in the following manner:

Uniform-sized rectangles of integument were removed from a dorso-ventral axis of the tail and autotransplanted to the backs of *Rana catesbeiana* larvae.

Artificial metamorphosis was induced and the grafts retransplanted, homoio-plastically, at two stages of histolysis, to non-metamorphosing larvae. The homoio-transplants were then fixed for sectioning at successive 3-day intervals and later examined for signs of histological regeneration.

Complete integumentary regeneration of transplants originally derived from median tail regions was always obtained before similar regeneration of the dorsal or ventral transplants. The regeneration of ventral transplants preceded slightly that of the dorsal transplants. The results in general, therefore, indicate the existence of a median-ventral-dorsal regenerative gradient for partially histolyzed anuran tail integument.

EMBRYOLOGY

Read

99. THE DEVELOPMENT OF FRAGMENTS OF THE FERTILIZED TRITON EGG CONTAINING THE SECOND POLAR SPINDLE BUT NO SPERMATOZOON. G. Fankhauser, Princeton University. (Lantern; 15 min.)

In the course of a detailed study of merogony in the European newt, *Triton palmatus*, a large number of fertilized eggs were constricted by means of a hair loop (Spemann's method) from 15 to 60 minutes after insemination. In 156 experiments the constriction isolated the second polar spindle in one half of the egg, while all spermatozoa of the normally polyspermic egg were confined to the other half.

Forty-nine fragments containing the polar spindle were preserved in an early stage for cytological examination. The remaining fragments were allowed to develop. Twenty-four of these never showed any sign of segmentation; in twenty-five, abortive cleavage furrows appeared, while complete furrows were formed in fifty-eight fragments. The cleavage of the latter was always delayed with regard to the controls and in most cases was abnormal. Development never continued beyond an early blastula stage.

The cytological examination shows that the second maturation division is completed in normal fashion in the majority of these egg fragments. The egg nucleus is formed and migrates toward the cytoplasmic center of the fragment. No aster is visible. From this point on the development may follow one of several courses:

- 1) The nucleus divides in the absence of an achromatic apparatus.
 - 2) A small but otherwise normal mitotic figure is formed with normal chromosomes and a spindle with polar asters.
 - 3) The egg nucleus degenerates without an attempt at division.
- Cleavage furrows may be formed in the absence of asters and often independently of any nuclear activity.

100. THE CAPACITY FOR DIFFERENTIATION OF REGIONS OF THE UNINCUBATED CHICK BLASTODERM. Elizabeth Bulter, Universities of Chicago and Rochester. (Introduced by B. H. Willier.) (Lantern; 15 min.)

The capacity for differentiation of regions of the unincubated chick blastoderm was tested by means of the chorio-allantoic graft. The blastoderm was

cut in various ways: coinciding with the antero-posterior axis of the future embryo, parallel to, perpendicular to, and at an angle of 45° to that axis. Grafts from pieces (many comprising only one-fourth of the pellucid area) which contained intact the median posterior region of the blastoderm sometimes showed excellent differentiation of gut, smooth muscle, epidermis, dermis, feather germs, central nervous tissue (notably pigmented and sensory retinal layers and mesencephalon), thyroid, cartilage, bone, heart, and liver. Pieces in which this region had been cut never gave grafts with more than gut, muscle, heart, liver, and skin. Totipotency, therefore, was exhibited only by those pieces in which the median posterior region was not disturbed.

1) The degree of differentiation attained in these grafts is in general comparable to that observed in grafts from primitive streak stages. 2) Cuts which would interfere with the cell movements, described by Wetzel ('29), as preparatory to primitive streak formation, seem to inhibit the totipotency of the piece grafted. This is not the case if the posterior median region, most actively concerned in primitive streak formation, is left intact. This suggests that the combined action of the cell areas to the right and left of the median line at the posterior end of the blastoderm is essential at this stage for the expression of totipotency.

101. REACTION OF CHICK EMBRYOS TO MECHANICAL SHOCK. Theodore C. Byerly and M. W. Olsen, Bureau of Animal Industry. (Lantern; 5 min.)

Fertile eggs at all stages of incubation were rotated about their long axes by means of mechanical rollers with clock-work control. The eggs were rotated about 120° at 15-minute intervals, always in the same direction. Mortality was very great from the fifth to the fourteenth day of incubation. About 40 per cent of treated embryos alive at the beginning of the sixth day, died on that day. About 24 hours' treatment was necessary for maximal effect. There was but little delayed mortality.

Mortality on the fifth to seventh day was largely due to twisting of the chalazae with resulting yolk-sac rupture. This emphatically negatives the persistent tradition that the chalazae serve to keep the embryo oriented for they were passively twisted and showed no tendency to untwist. Much of the later mortality was caused by twisting of the yolk stalk and consequent physiological occlusion of blood vessels and by disjunction of the chorio-allantois and shell membrane with resulting hemorrhage.

Other lots of eggs were shaken for from 1 to 64 minutes on a particular day of the incubation period. A mechanical shake moving through a 6.3 cm. arc 229 times per minute was used. Maximal effect was produced by 16 minutes shaking. The mortality curve was similar to that for the rotated eggs. Rupture of the yolk-sac and disjunction of the chorio-allantois and shell membrane with hemorrhage were major immediate causes of death. There was no delayed mortality.

102. REACTION OF CHICK EMBRYOS TO DIFFERENT ENVIRONMENTAL TEMPERATURES.

Theodore C. Byerly and M. W. Olsen, Bureau of Animal Husbandry. (Lantern; 5 min.)

Lots of approximately 100 fertile eggs each were incubated for various periods from 0 to 36 hours at 37.5°C. Each lot was then subjected to a temperature of 43°C. for 12 hours and subsequently incubated at 37.5°C. till hatching time. Mortality attributable to treatment increased from 18 per cent in the 0-hour lot to 100 per cent in the 30-hour lot; terata attributable to treatment increased from 0 in the 0-hour lot to 42 per cent of classifiable embryos in the 30, but dropped 17 per cent in the 36-hour lot. Terata were chiefly microphthalmic; ectopia and/or exencephaly also occurred in a few cases.

Other lots of eggs were incubated at 32°C. for various periods then at 37.5°C. till hatching time. Others were incubated at 37.5°C., then at 32°C. and finally at 37.5°C. Neither slow development at 32°C. followed by normal temperature nor incubation at 32°C. after a period at 37.5°C. produced many terata. A lot incubated 144 hours at 32°C. then at 37.5°C. contained five cases of ectopia, 17 per cent of classifiable embryos. Mortality attributable to treatment in this case was 66 per cent.

There was no difference in susceptibility of the sexes of unfavorable environmental temperature. Mortality curves for newly hatched males and females subjected to lethal temperatures were also practically identical.

103. REGENERATION OF THE TAIL-FINS OF FUNDULUS EMBRYOS. James H. Birnie,

Brown University. (Introduced by H. E. Walter.) (Lantern; 15 min.)

Embryos of *Fundulus heteroclitus* were removed from the chorion between the twelfth and fifteenth day of development and were operated upon so as to remove half of the basal plate of the tail together with the differentiated and undifferentiated ray material distal to it. New rays had definitely appeared 17 days later at the cut edge of the basal plate regardless of whether the part of the plate is derived from the spines or from the original central plate. (In these embryos the basal plate of the tail-fin is derived partly from the original central plate and partly from the neural and hemal spines of the four vertebrae immediately anterior to it.) The plate regenerates very slowly as compared with the rays, returning to its original shape only after 50 days. When the entire basal plate and all parts distal to it are removed no regeneration of the plate or rays could be observed at the end of 65 days.

By demonstration

104. THE EGG OF *SABELLARIA VULGARIS* V. AND ITS FERTILIZATION REACTION. A. J.

Waterman, Brooklyn College.

Sabellaria vulgaris which inhabits sand tubes on dead *Echinarachnius* and other shells and in Bryozoa nodules occurs abundantly in the vicinity of Woods Hole. The early development has been followed from shedding to early cleavage and a comparison made with *Sabellaria alveolata* as described by Fauré-Fremiet. With minor exceptions, the development is strikingly similar. Particular study has been made of the fertilization phenomena and of the relation between the point of sperm entry and the first cleavage plane.

Animals shed freely when removed from their tubes. Immediately the eggs become spherical, the vitelline membrane elevates and contents of the germinal vesicle form a clear area at the animal pole. Visible polarity appears during prematuration.

It is said that fertilization occurs normally during May and June. After this a high per cent of cleavage stages may be obtained by alkaline sea water (8.6) except for a period from about August 1st to 20th which may indicate a second normal shedding time. Highest per cent of cleavage is obtained when males and females shed together. Fine protoplasmic processes connecting egg and vitelline membrane play an important part in fertilization and their disappearance indicates that a sperm has entered. Fertilization cone is enormous and changes shape. Sperm may enter at any point on the periphery but more frequently in animal hemisphere. Polar bodies are large and may divide. Plane of first cleavage bears no fixed relationship to sperm entrance point and passes to one side of pole as determined by position of polar bodies.

105. DEMONSTRATIONS ON GONADAL DEVELOPMENT IN BIRDS. Emil Witschi, State University of Iowa.

In sparrow females of the eighth day of incubation both ovaries contain large numbers of primitive gonidia scattered throughout cortex and medulla. The cortex of the right side is little developed and consists of several disconnected patches. One day later, most of the gonidia of the left ovary have transformed into oocytes. The characteristic synaptic changes appear simultaneously in the cortical and medullary regions. At the same stage only relatively few oocytes are formed in the right ovary and their occurrence is restricted to the cortical patches. The gonidia within the very conspicuous medullary cords do not show the female differentiation though presently disappear by direct degeneration. It is with extreme rarity that one finds cortical remnants in adult sparrow females. As a rule only mesonephric rudiments of the sex apparatus are retained, consisting of little differentiated rete cords, more conspicuous mesonephric tubules and very highly developed vasa deferentia.

Results indicate that factors more physical in nature than those employed with the blastulae of *Paracentrotus lividus* will also inhibit gastrulation at this late stage. Blastulae of *Arbacia* are less susceptible than those of *Paracentrotus* to LiCl and to isotonic salt solutions.

106. DEVELOPMENT OF THE HAIR FOLLICLE AND HAIR IN VITRO. Margaret R. Murray, Columbia University.

Explants taken from the heads of rat embryos near the end of the second week in gestation afford material for direct study of the differentiation of the hair follicle from its primordial state up to that at which the hair extends through the hair canal. The topography of the follicle is rather normal notwithstanding the varied tensions which it is assumed to be subjected to throughout a week or more of development in vitro. Pigment develops in the hair-bulb immediately above the dermal papilla.

By title

107. PRIMORDIAL GERM CELLS IN A 4.5 MM. HUMAN EMBRYO. G. W. D. Hamlett, Harvard Medical School.

A 4.5 mm. human embryo in the author's collection shows numerous germ cells migrating toward the region of the germinal ridge. The germ cells are definitely localized, and are perfectly distinct from the various kinds of somatic cells. They are larger than most of the mesenchymal cells, and their cell membrane is much more distinct. The most diagnostic feature, however, is their almost perfectly transparent cytoplasm. In some of the germ cells the cytoplasm contains a cap-shaped region, staining faintly with eosin, at one side of the nucleus. This is not visible in all the cells, probably because of the plane of sectioning; it is not found in any of the somatic cells.

At this stage, most of the germ cells are in the dorsal mesentery of the gut. A few are in the entoderm, and some have already reached the region of the germinal ridge. Most of them lie in the mesenchyme, a few are in the single-layered peritoneal epithelium. The cells are distributed from the level of the anterior end of the mesonephros to the region of the cloacal membrane, the greater part of them lying about midway between these points. None were found outside these limits. The total number of germ cells counted was 290. A complete description, with photomicrographs, will appear later.

108. FERTILIZATION MEMBRANES OF ASTERIAS EGGS CENTRIFUGED BEFORE FERTILIZATION. Donald P. Costello, University of Pennsylvania. (Introduced by L. V. Heilbrunn.)

The eggs of *Asterias forbesii*, subjected to a strong centrifugal force during the early maturation period, stratify, then elongate and pull apart into two fragments inside of the jelly hull. The centripetal light fragment contains the oil, hyaline zone, and some yolk spheres, and the smaller centrifugal fragment contains the remainder of the yolk. If these fragmented eggs are inseminated immediately, there is a sharp difference in the cortical response of the lighter as compared with the heavier half. A normal fertilization membrane separates from the heavy fragment whereas the light fragment shows no membrane separation except for a thin, partial membrane limited to the extreme centrifugal pole. Between the fertilization membrane of the heavy fragment and the egg cortex lies a perivitelline space of normal width. The thin fertilization membrane at the centrifugal pole of the light fragment is separated from the egg cortex by a narrower perivitelline space, which parallels in width the thickness of the fertilization membrane. These facts and other more indirect observations are interpreted as evidence that membrane separation involves specific materials which can be displaced into the heavy half of the egg by centrifugal force.

109. PRELOCALIZATION OF ORGAN-FORMING SUBSTANCES IN THE EARLY EMBRYO OF *DROSOPHILA MELANOGASTER*. Ruth B. Howland and George P. Child, New York University.

To insure production of fertile isogenic eggs which would develop at a uniform rate, virgin females of a scute-1 stock which had been inbred for twenty-two generations and selected for fecundity and fertility were isolated at eclosion and aged for 3 days before mating. On the fourth day, the males were removed, and the females put into small vials containing thin strips of banana-agar stretched on microscope slides. These were removed at frequent intervals, and the eggs (of known ages) oriented on freshly cut agar blocks. Ooplasm varying in amount, was removed from different levels by means of microneedles. The level of operation could be kept fairly uniform because of the symmetry of the egg. Resulting adult abnormalities were recorded. From approximately 1500 eggs, varying in age from 2 to 17 hours, there was obtained a percentage abnormality of 16.4. Rigid examination of 5000 controls gave but 0.18 per cent abnormal. This contrast is clearly significant. The abnormalities in controls and operated flies were of the same general types, i.e., eye missing or small, half thorax, club wing, etc. The repeated occurrence of a definite type of adult abnormality after egg puncture at a definite level supports the conclusion that organ-forming substances are localized in these eggs even in the earliest stages. This conclusion is also supported by the genetic evidence on mosaics.

110. POTENCIES OF THE MESECTODERM OF EARLY CHICK BLASTODERMS. Thomas E. Hunt, University of Alabama.

Chorio-allantoic grafts were obtained from transplants of the mesectoderm of the area pellucida of early chick blastoderms from which the entoderm was completely removed. Of the eighty-eight grafts obtained approximately half were from a region that included part or all of the primitive streak. The others included only the region lateral to the streak. In about half the grafts of both regions there appears a gut-like formation that corresponds in structure to the gut appearing in grafts of all germ layers. Such formations, which are very similar to the normal embryonic gut, have connective tissue and muscular tunics. In the grafts containing the anterior part of the streak, liver and trachea (or bronchi) are present in four cases and in three there is thyroid as well. There also occurs in varying frequency, central and peripheral nervous tissue, choroid plexus, parts of the eye, notochord, epiphysis, heart, mesonephros, cartilage, skeletal muscle, skin and feather germs. Since these structures will differentiate in grafts in the absence of entoderm, it is concluded that the latter has little if any role in their differentiation during the stages of development studied (blastoderms with streak lengths from 0.9 mm. to 2.4 mm.). The presence of entodermal structures in the grafts indicates a much greater potency of the mesectoderm than has usually been attributed to it. Results from grafting the entoderm alone agree with those of Willier in showing that it has only a very slight capacity for differentiation.

111. THE ORIGIN OF THE TUBULI EFFERENTIA AND EPIDIDYMAL TUBULES IN THE DOMESTIC FOWL. J. C. Gray, Western Reserve University.

The tubuli efferentia are differentiated and clearly identified at 9 to 10 weeks after hatching. Their origin is demonstrated by a study of a series of stages from 1 to 9 weeks post-hatching. The tubuli efferentia differentiate and develop from Bowman's capsule of the mesonephric tubule, and in addition, a very short portion of the tubule adjoining the capsule may be incorporated. Shortly after hatching, the squamous epithelium of Bowman's capsules begins to change to cuboidal epithelium, the rete network of the glomerulus indicates no degeneration. Between 4 to 8 weeks the epithelium of the capsule becomes low columnar, the capsule may or may not increase in size. During this time the glomerulus shrinks in size and finally only a few strands of connective tissue are left within the capsule. At about 7 weeks villus-like folds begin to form from the capsular epithelium and the capsules increase in size. Cilia are produced on some of the epithelial cells particularly at the tips of the forming folds. At 10 weeks the efferentia is completely developed and connection has been made with the rete testis.

The mesonephric tubules become the epididymal tubules. There is practically no change morphologically in the mesonephric tubule. By 10 weeks, then, there is a complete duct system from the seminiferous tubule to the mesonephric duct, the latter now called the vas deferens.

No evidence has been found that any part of the mesonephros degenerates and disappears during the formation of the epididymis.

112. NUTRITIVE PROCESSES IN THE EMBRYOS OF THE GOODEIDAE, VIVIPAROUS TOP MINNOWS OF MEXICO. C. L. Turner, Northwestern University.

Nutritive processes were described by the writer in 1932 for the embryos of several species of Goodeidae, a family of viviparous top minnows confined for the most part to the Mexican Plateau. The study has now been extended by an examination of gravid females in the collection of the Field Museum. One species not available at the Field Museum was studied at the United States National Museum by C. L. Hubbs.

All but four or five species have now been studied and all but one shown to have the nutritive processes. This one species is found outside of the Mexican Plateau in a river draining into the Gulf of Mexico and probably represents an ancient relict.

The nutritive processes are quite constant for each species but are extremely variable in the family as a whole. A rosette type is obviously the most primitive. More specialized types are sheathed and unsheathed ribbon-shaped processes.

The peculiarities of the processes, together with peculiarities in ovarian structure, are being used by C. L. Hubbs and the writer in making a revised classification of the family.

113. THE SPERMATOGENETIC AND SEASONAL CYCLE OF THE TESTIS OF THE MUSK TURTLE, *STERNOTHERUS ODORATUS* (LATREILLE). Paul L. Risley, State University of Iowa. (Introduced by E. Witschi.)

The spermatogenetic cycle of the musk turtle closely parallels that of amphibian forms, but does not coincide with known information on other reptiles. Multiplication of spermatogonia begins in early May before the completion of the periodic involution of the testis, reaches a high point near the middle of June, and gradually slows until August. Primary spermatocytes and maturation divisions appear near the middle of June, and continue throughout the month of July and occur sporadically in August. Spermiogenesis begins in the latter part of July, reaches its height during August, and is completed by the end of September. The relation of the germ cells to the Sertoli cells is almost identical with that seen in the mammalian testis. During the fall and winter months the sperm are stored mainly in the epididymis, or in the oviducts of the females. Breeding may occur in either fall or spring. A pronounced decrease in the size of the testis and a corresponding increase in the size of the epididymis is noted at the end of the cycle. Involution of the testis tissue occurs mainly during the months of March, April, and May, with only slight changes observed over the winter. Regeneration occurs mainly in May.

Observations on the interstitial cells show that a maximal size and number is attained during the fall, winter, and early spring (breeding and hibernation periods). Minimal development is associated with the spermatogenetic activity of the testis.

114. THE ABILITY OF THE IMMATURE OVARY TO FUNCTION IN THE ADULT CASTRATED RAT. Carroll A. Pfeiffer, State University of Iowa. (Introduced by Emil Witschi.)

Sexually mature female rats (eight cases) were castrated and the ovaries of the newborn transplanted into the dorsal part of each kidney at the time of ovariectomy. The ovarian grafts took readily and oestrus reappeared after a lapse of 15 to 20 days. Usually the oestrous cycles were irregular, often with prolonged oestrous periods. The grafted ovaries, for the most part, were cystic. The secondary sexual characters, in general, were maintained. After the removal of the grafts the host returned to anoestrus.

Oestrous cycles were not obtained by transplanting the ovaries of newborn into adult females that had been castrated at birth.

115. FURTHER STUDIES OF EXOGASTRULATION IN THE SEA URCHIN. A. J. Waterman, Brooklyn College.

The phenomenon of exogastrulation characterized by inhibition of the gastrulation processes, external differentiation of endoderm and the excessive proliferation of mesenchyme, has been produced in *Arbacia punctulata* following the exposure of blastula stages to hypotonic sea water, lowering and elevation of temperature and to x-rays.

Dilutions of sea water of 45 per cent to 65 per cent give the most numerous cases of the different methods employed. A few occur at 30 per cent to 45 per

cent dilutions. Development is typical at 27°C. but at higher temperatures becomes increasingly irregular and abnormal. At 35°C., the cultures die. Shallow exogastrulae appear at 28° to 31°C. Lowering of temperature has little effect upon gastrulation. Development is fairly typical but retarded at 7°C. At 2° to 4°C., an occasional shallow exogastrula occurs. In the x-ray experiments, dosages of 720^r/minute at 20 cm. distance for 6 to 12 minutes give a small percentage of cases.

Various stages of blastulation appear equally sensitive and the effect is progressive. With increase in length of exposure and in strength of stimulus the more resistant individuals become affected while the more susceptible ones are killed. In every case the exovation is shallow and the type does not differentiate except for apical plate and stomodaeum. Fusions, ectodermal constrictions and permanent blastulae are common.

116. SURVIVAL OF RAT FETUSES FOLLOWING ELECTRO-CAUTERY OF THE BRAIN. E. L. Corey, University of Virginia.

Albino rat fetuses of from 18 to 26 mm. crown-rump length may survive until term following cautery of the brain in the region of the hemispheres. Viable fetuses showing spontaneous movements similar to those exhibited by their litter controls were recovered from the uterus 6 days following cauterization. The general vascularity of the operated animals appeared to be unimpaired. In several cases operated fetuses were found to have more than doubled in crown-rump length when measured on removal from the uterus (no. 1-a, 12 mm. when operated; 32 mm. when sacrificed). In experiments to date, involving eight litters and thirty-two operated fetuses, the cauterized animals were invariably of slightly less C-R length and weight than their litter controls. At term the fetuses (six cases) were either born dead or died in utero. In the latter cases the mother also succumbed. Cursory histological examination of cauterized fetuses has revealed the (apparent) occurrence of hydrocephalus, complete destruction of the cortex, absence of ventricles and choroid plexus. A detailed knowledge of the regions affected awaits a more complete histological study. Rat fetuses may survive the injection of carbon ink into the region of the hemispheres and continue apparently normal growth for at least 4 days. Hydrocephalus has thus far not been observed to result from such injections.

117. HETEROPLASTIC TRANSPLANTATIONS OF RANA SYLVATICA TAIL BUD TO AMBLYSTOMA PUNCTATUM. E. D. Goldsmith, Harvard University. (Introduced by H. W. Rand.)

In an attempt to determine the fate of an anuran tail on a urodele at the time of metamorphosis transplants of *Rana sylvatica* tail buds were made to various regions of *Amblystoma punctatum* larvae (stages 27 to 33). The grafts developed into somewhat typical tails, but of subnormal size. In many cases, an outgrowth of host tissue occurred at the site of implantation and served as a base for the graft.

After periods varying from 7 to 40 days, the *Rana* tails gradually assumed the pigmentation of the host, so that at the time of metamorphosis their pigment (with two exceptions) was similar to that of the host. At this stage, approxi-

mately 95 days after the operation, simultaneously with the loss of the tail fin and the reduction in the size of the gills of the *Amblystoma*, the *Rana* tail became smaller and smaller, so that when the larval pigment had been succeeded by that of the adult, the graft was present only as a very small flap, or had been completely absorbed. Whether this flap was the 'outgrowth of host tissue' or actually a vestige of frog tail comparable to that portion remaining after typical anuran metamorphosis; and, whether the change in pigmentation was but an indication of a superficial change, or of a replacement of the deeper frog materials by that of *Amblystoma* will not be evident until an histological examination is made.

118. TRANSPLANATION OF CHICK METANEPHRIC TISSUE TO THE CHORIO-ALLANTOIC MEMBRANE OF THE DUCK. Carl J. Sandstrom, New York University.

Reciprocal heteroplastic chorio-allantoic transplantations of metanephric tissue between duck and chick embryos of comparable ages yielded grafts that were histologically similar, provided the implants were incorporated fully into the host membrane. Incorporation of duck kidney tissue by the chick membrane (reported on previous occasions) was usually successful although the rate was found dependent on the age of the donor tissue. The reverse, i.e., incorporation of chick tissue by the duck membrane, did not take place as readily, even when earlier stages of donor tissue were used. This delay had a decided effect on the implanted tissue. There were no indications of an aggressive host reaction toward the implant, for once within the membrane, the still undifferentiated metanephric tissue of the chick that survived the prolonged process of incorporation, grew and differentiated into normal tissue. As homoplastic transplants of duck kidney tissue were incorporated quickly, the difference in the rate of incorporation between duck and chick implants indicates the presence of something of a specific nature in the chick tissue which inhibits the process of incorporation. A similar factor is apparently either absent or ineffective in the duck, since duck kidney tissue was readily incorporated into the chick membrane.

The results support the contention that the factors determining the transplantability of foreign tissue in chorio-allantoic grafting are of the donor, and that the host does not react aggressively toward the implant.

119. BEHAVIOR OF LARVAL GRAFTS UPON ADULT *TRITURUS VIRIDESCENS*. W. H. Wright and H. H. Collins, University of Pittsburgh.

The following types of premetamorphic larval fragments (age range from 1 to 3 months) have been successfully transplanted to various locations on the body surface of the adult: larval tails, with and without hind limb bud anlage; fore and hind limbs; eyes; whole heads and half heads; and external gills.

Tail grafts exhibited variable growth following implantation. In one case, a graft grew 7 mm. in 70 days. The form was fairly characteristic.

A larval head implanted upon the head of an adult host became heavily vascularized, then increased to about four times its original size when growth ceased, 34 days after operation. The eyes underwent some degeneration and the characteristic external features in general became indistinct, within a period of 90 days.

Limb bud grafts exhibited but slight vascularization. Digit buds developed but resembled regenerating adult digits more than normal digits of the larval limb. Another indication of host influence upon the graft was seen in the increased diameter of the limbs, larval limbs being much more slender.

In one case where both a tail and a limb developed from the same implant, independent movements of each were observed.

HISTOLOGY AND CYTOLOGY

Read

120. THE ORIGIN AND NATURE OF THE NUCLEOLUS. Mary S. Gardiner, Bryn Mawr College. (10 min.)

In the developing eggs of *Limulus polyphemus* and *Tenebrio molitor*, the nucleolus is formed by the confluence of droplets of material which enters the cell from outside and passes across the nuclear membrane. The nucleolus in these cells consistently fails to give the Feulgen reaction, contributes no substance to the formation of the chromosomes, and is most probably connected with the processes of vitello-genesis. The amount of chromatin, here defined as the Feulgen-reacting substance, is approximately constant during all stages of oogenesis, although it may become so greatly dispersed in the cell as to give only a faint reaction, or in cases of extreme dispersion, no visible reaction at all. The explanation of the failure of the chromatin in some oocytes to give the Feulgen reaction lies in the degree of its dispersion rather than in any chemical change in it.

121. THE MEMBRANOUS LABYRINTH OF THE DOGFISH. R. E. Bowen, Long Island University. (Introduced by Secretary of Section F.) (Lantern; 10 min.)

The ampullar organs of the ear of the dogfish, *Mustelus canis*, were examined in the fresh condition by means of transmitted light and dark-field illumination. Fresh tissues, consisting of entire cristae and associated walls of ampullae, were used, and in some cases, while under direct observation, such living tissues were subjected to the effects of various reagents. The sensory hairs were found in normal condition when the tissues were immersed in sea water, but not in Ringer's solution or in diluted sea water. Solutions of markedly lower or higher saline concentration than sea water caused alterations in the appearance and, frequently, a reduction in numbers of the sensory hairs. These processes were found, in the living condition, to be slender, tapering hair-like structures, varying in length from 35 to 60 μ , with the latter figure representing the length of by far the greater number. Unless disturbed, there was no clumping together, the hairs remaining distinctly separate and projecting at right angles from the neuro-epithelial layer. The hairs seemed to be somewhat more resistant to changes in saline concentration than was found to be the case in the fresh water *Ameiurus nebulosus*. Movements of single processes were seen in two dissections. The cupula, as in *Ameiurus*, is produced by the fixation of a thinly mucilaginous secretion. Materials, apparently secretions, were found, in numerous cases, to appear among the sensory hairs along the neuro-epithelial crest.

122. PSEUDOPODIA AND FLOWING MOVEMENTS IN LIVING GERM CELLS. W. J. Baumgartner, University of Kansas. (Lantern; 10 min.)

That living germ cells in a nutrient solution form pseudopodia has been known almost ever since tissue culture has been practiced. These projections have usually been associated with resting nuclei, or with degenerating stages due to hypertonicity. During the past summer the author aided by a class of cytology students was able to connect the formation of pseudopodia with a very definite stage in cell division in insect germ cells. During a short period in the anaphase stage while the spindle and the cell are both elongating, the cell wall at the poles bulges and gets thinner and seems almost to disappear. Then one or more broad or rod-shaped pseudopodia appear. They project straight or obliquely from the poles and exhibit some movement. Some are quite long and prominent. At about the time the equatorial constriction begins the projections are withdrawn and the cell wall becomes smooth, of even thickness, and rounds out the cell. The daughter cells are formed and pass into the normal telophase stage. Such pseudopodia are never seen in cells within the testicular tubules. The higher pressure likely prevents them. Hypertonicity cannot be a causal factor else the cells would hardly return to normalcy. It is believed that these temporary pseudopodia are the result of the changed osmotic pressure and the flowing of the cytoplasm so often described in connection with cell division and chromosome movement.

123. THE OVARIAN CYCLE IN *TRITURUS VIRIDESCENS*. Helen M. Hilsman, University of Pittsburgh. (Introduced by H. H. Collins.) (Lantern; 8 min.)

The egg laying season for *Triturus viridescens* occurs from the end of March to the end of June. During this time the mature eggs are laid leaving only very young eggs in the ovary. July then, is the logical beginning of the ovarian cycle. The July ovary contains only oogonia and small oocytes. The oogonia have the faintly staining polymorphic nuclei and the characteristic follicle cells. The small oocytes can be distinguished from the oogonia by their large reticulated nuclei and the relatively small amount of cytoplasm. Each oocyte is surrounded by the connective tissue sheaths and follicle cells. During July, August, and September the oocytes increase in size. When the egg reaches approximately $500\ \mu$ in diameter there appears a less dense area in the cytoplasm midway between the nucleus and the periphery of the egg, outside of which the yolk is laid down. This area then moves closer in to the nucleus as the yolk is deposited in the periphery until it disappears and the entire cytoplasm is filled with yolk. October is the first month in which any definite yolk material is formed, the ovary now contains large yolk laden eggs and many smaller oocytes. From October through the winter until the spring breeding season the oocytes continue to grow and form yolk until each ovary contains about 250 large yolk laden eggs approximately $1500\ \mu$ in diameter. It is demonstrated by the present study that a complete ovarian cycle requires 1 year's time to mature all the eggs for one season.

124. FOLLICULAR ATRESIA IN THE BAT, *MYOTIS LUCIFUGUS LUCIFUGUS*. Katharine R. Jeffers and Mary J. Guthrie, University of Missouri. (Charts; 10 min.)

Follicular atresia was studied in ovaries from bats collected at frequent intervals during the hibernation period from November to April. Atresia begins in follicles while the granulosa is less than five cell layers in thickness. Two types of atresia occur. In one type the oocyte degenerates while the granulosa remains normal. The ultimate fate of the granulosa cells is not known. Such retrogression occurs in follicles with one to two layers of granulosa cells. In the second type of atresia, the granulosa becomes abnormal first; this is followed by the slow disintegration of the oocyte, which is finally invaded by wandering cells. However, spindles may appear in the oocytes early in atresia, and polar body formation has been observed. Multinucleate, divided, and fragmented oocytes also occur in such follicles. The region occupied by the follicle is finally obliterated by ingrowth of connective tissue.

125. THE PITUITARY GLAND, OVARIES, AND REPRODUCTIVE TRACT OF THE BAT, *MYOTIS LUCIFUGUS LUCIFUGUS*. Mary J. Guthrie, Katharine R. Jeffers, and Elizabeth L. Sawyer, University of Missouri. (Lantern; 15 min.)

The pituitary glands, ovaries, and reproductive tracts of bats collected from caves at intervals from November to April have been studied cytologically in order to find if any correlation exists between the endocrine coordination proposed for the reproductive cycle in other mammals, the supravital observations on these specimens, and the cellular structure. It is not possible to classify the cells of the anterior lobe of the pituitary gland under different types. Data on nuclear size and structure, size of cytosome, and kind and degree of its granulation indicate a secretory cycle conspicuously reduced in output during the hibernating period. The number of normal non-vesicular follicles increases until mid-December and then decreases. Atretic follicles become more numerous until the end of February at which time another follicular cycle begins. The single follicle of ovulation is vesicular in November and undergoes little change until the period preceding its rupture. At the time of the fall insemination amoeboid cells enter the lumen of the tract by migration through the mucosa and begin to phagocytize the sperm. There is another such migration at the time of the spring insemination and ovulation. A conspicuous branching of uterine glands occurs coincident with ovulation. The vaginal lining is heavily cornified in the autumn after insemination has occurred. Cornified cells are sloughed at the period of spring insemination and ovulation. This is immediately followed by desquamation of epithelioid cells beneath which new cornification is occurring. These statements are based upon correlations in sixty females killed within 24 hours after collection.

By demonstration

126. CYTOLOGY OF HYPERMASTIGOTE FLAGELLATES. L. R. Cleveland, S. R. Hall, Elizabeth P. Sanders, and Jane Collier, Harvard University.

As many demonstrations will be given as time and space permit of the life-cycle of the centriole, formation of the achromatic figure from the centriole, and the mechanism of chromosomal movement.

127. MATURATION AND CLEAVAGE IN FERTILIZED AND UNFERTILIZED GRASSHOPPER EGGS. E. H. Silfer and R. L. King, State University of Iowa.

The maturation and early development of both fertilized and unfertilized eggs of *Melanoplus differentialis* have been studied by the use of a technique recently described (Science, 78: 366). Immediately after the eggs had been laid they were placed in a thermostat kept at 25°C. from which they were removed and fixed at definite intervals in order to secure material of a known age and temperature history. Since the unfertilized eggs undergo two maturation divisions as do the fertilized it seems certain that in this form maturation is independent of insemination and that unfertilized eggs start their development with the haploid number of chromosomes. It has previously been shown that the diploid number of chromosomes may be eventually restored in such parthenogenetically developing grasshopper embryos.

128. THE SEX CHROMOSOME MECHANISM AND SEX DETERMINATION IN *SCIARA*. C. W. Metz, Carnegie Institution and Johns Hopkins University.

Sex is determined in *Sciara* by a complex series of processes. Although incomplete, evidence now warrants formulation of working hypothesis (see earlier papers). Essentially 'unisexual' progenies are produced. 'Sex of progeny' is determined by mother's zygotic sex chromosome constitution (XX gives males; X'X gives females). Male apparently transmits only maternal chromosomes. Egg transmits one sex chromosome. Due to peculiar second spermatocyte division sperm regularly transmits two sister halves of one chromosome—apparently the maternal X. Evidence suggests that one chromatid is altered in this process. Fertilized egg apparently receives three sex chromosomes—one maternal, two paternal.

Late spermatogonia and oogonia contain only two sex chromosomes; female soma contains two; male soma only one. These numbers result from chromosome elimination during cleavage. Seems certain that one (not necessarily same one) of the two sister chromosomes transmitted by sperm is regularly eliminated. To account for this necessitates assumption of an alteration in one as suggested by cytological evidence. It is postulated that this alteration changes an X functionally into a Y and that sperms all transmit XY. If gonads are self-differentiating as in other insects male germ-line should be XY and female XX. All cells retain maternal X. It is postulated that retention of paternal X throughout embryo gives female, and that loss of paternal X and Y from soma but retention of Y in germ line gives male. These events finally determine sex of individual fly. Ordinarily eggs from X'X mothers follow one course, those from XX mothers the other.

129. THE EFFECTS OF SOME FIXING REAGENTS UPON THE SENSORY ENDINGS OF THE EAR OF THE DOGFISH. R. E. Bowen, Long Island University. (Introduced by Secretary of Section F.)

Sensory endings of the ear of *Ameiurus nebulosus*, when subjected to the action of various fixing reagents, show, in numerous cases, as with formalin, a noticeable shrinkage, the hairs, however, still remaining visible. Great distortion is

caused by some reagents, and with others, the hairs are completely destroyed. Fixatives were applied to the ampullar organs of the dogfish, *Mustelus canis*, after the tissues had first been examined in the fresh condition. The sensory hairs were kept under observation during the action of the fixing solutions and the following results noted:

Formalin, 10 per cent: Much distortion and shortening of the sensory processes within 10 minutes.

Formalin 20 per cent: Much less distortion than with other reagents. After 20 hours there was some shortening of the hairs, which still remained erect and very distinct. This solution, when first applied, produced some shrinking and bending of the hairs. Many, however, remained in good condition.

Lavdowsky's: Complete obliteration of the normal hairs within 5 minutes.

Bouin's solution: Marked shrinkage and distortion of the hairs within 10 minutes, and general shrinkage in the tissues of the crista and the neighboring ampullar walls.

Zenker's fluid: Hairs showed marked distortion, with shortening and bending.

Flemming's: Processes became altered in appearance and arrangement. There was shortening of some of the hairs, twisting and bending of others, and, in general, marked distortion.

Gilson's mercurio-nitric: Sensory hairs were destroyed with 5 minutes; accompanying this was re-arrangement of the usual cupular patterns.

Twenty per cent formalin appears to be the only safe fixative for the sensory hairs.

By title

130. THE HISTOLOGY OF THE MALPIGHIAN TUBULES OF MELANOPLUS DIFFERENTIALIS. Richard R. Stuart, State University of Iowa. (Introduced by H. W. Beams.)

A histological study has been made of the malpighian tubules and adjoining portion of the alimentary tract, the 'pyloric valve,' of the common grasshopper, *Melanoplus differentialis*.

The tubules vary in number from about 190 to 300. They gather into twelve groups each consisting of an anterior and a posterior division and each emptying into one of twelve ampullae arranged equidistant from each other about the wall of the posterior midgut just anterior to a sphincter muscle which marks, externally, the junction of mid- and hindgut, that is to say, the 'pyloric valve.' The lumen of each ampulla is continuous with one of twelve furrows formed by the gathering of the hindgut epithelium into as many longitudinal folds.

The wall of the digestive tube is made up of 1) an inner epithelium (tall columnar cells), 2) an intermediate tunica propria (connective tissue), and 3) an outer muscular coat (inner circular and outer longitudinal layer). The midgut epithelium dips down at frequent intervals to form crypts at the bases of which are the 'nidi.' This epithelium is covered, on its luminal surface, by a curious striated border. The epithelium of the hindgut appears to be covered by chitin.

A malpighian tubule consists of a single layer of large polygonal cells with indistinct borders. It is covered externally by a thin membrane made up of 'peritoneal cells' and internally by a striated border similar to that in the midgut.

131. HISTOLOGICAL CHANGES IN A PROLAPSED INTESTINE OF A FISH, *MOLLINIENISIA LATIPINNA* LE SUEUR. R. F. Nigrelli and C. M. Breder, Jr., New York University and New York Aquarium.

A male *Mollinisia* with a prolapsed gut was observed for 3 months. The fish ate freely and characteristic attempts to mate were continued. On autopsy, the internal organs appeared normal, including the alimentary tract as far as the intestine proper which ended blindly. The exposed gut passed through the anus into the body cavity and ended in small, brush-like, blind tubules. How the fish was able to function is not clear, but regurgitation of what was destined to become faeces may have taken place. Histologically the abnormal gut is differentiated into two parts. That part internal to the vent is characterized by degenerated cellular elements. The villi are broken down and formed into islets or cords of cells within the lumen. The cells are vacuolated or show degeneration granules and the nuclei are pycnotic. Capillaries are few and the erythrocytes mostly basophilic. The prolapsed part is characterized by definite proliferation. The entire lumen is occluded with cellular elements showing definite signs of histological changes. These cells were identified as flattened epithelia, myofibrils, fibroblast-like cells and mesenchymal cells. Certain basophilic epithelium-like cells showed mitosis. Scattered throughout the tissue are found large numbers of capillaries and blood lacunae, in which the hemal elements appear normal. Few basophilic erythrocytes were encountered. The vascular connection with the deriving organism may account for differences in histological change not found in other vertebrate intestines when completely separated as in tissue culture.

132. A SUGGESTION AS TO THE ORIGIN OF ORIENTED SMOOTH-MUSCLE STRATA IN THE WALL OF A TUBE. Frederic T. Lewis, Harvard Medical School.

Among the mysteries of development in the intestinal tube is the method of production of the layer of circular smooth-muscle fibers, outside of which is a layer of longitudinal fibers, at right angles with the circular, both being produced from a uniform mesenchyma. This admits of a simple a priori explanation. If the wall of a tube is composed of isodiametric cells enlarging and dividing equally in all planes, the cells will remain isodiametric. But if there is a stratum in which divisions occur only in the tangential and transverse planes of the tube, with few or none in the radial plane, a layer of circular fibers inevitably results as the tube expands. With divisions in the radial and tangential planes, with few or none in the transverse plane, a layer of longitudinal fibers is formed. Data as to the actual divisions not being available, an investigation in cooperation with Professor Weatherford is in progress, dealing with this and other volumetric features of smooth-muscle. But it is known that in the intestinal epithelium, radial and transverse divisions occur, with none tangential, and the result, as expected, is a single layer of columnar cells with axes at right angles to the long axes of both sets of muscle fibers. The formation of the two sets of muscle fibers at right angles with each other seems therefore subsidiary to the problem of what determines the plane of cell division, and on that fundamental topic we have no suggestion to offer.

133. ORIGIN OF MELANOPHORES IN *PLATYPOECILUS*. Roy Tasker, Cornell University. (Introduced by Secretary of Section F.)

Studies on the origin of melanophores in *Platyopocilus maculatus*, one of the viviparous cyprinodonts, indicates that these cells are mesodermal. They arise in the loose connective tissue of the corium adjacent to blood vessels, nephric ducts, and the dorsal nerve cord. These cells are few and scattered at first but increase rapidly, forming relatively dense masses. In form, size, and location of the nucleus they are identical with the connective tissue cells among which they appear. The first melanophores make their appearance in the cephalic end, gradually extending caudad. The retinal pigment cells precede all others in the order of appearance. It is not revealed whether all chromatophores appearing throughout the life of the animal are the same in origin.

134. ABSENCE OF ROUGET CELLS ON THE BLOOD CAPILLARIES OF *NEREIS VIRENS*. H. W. Beams, R. R. Stuart and J. E. McCroan, State University of Iowa.

Efforts to demonstrate Rouget cells on the capillaries of *Nereis* comparable to those described for the capillaries of certain vertebrates by Krogh and Vimtrup were unsuccessful. However, it is not uncommon to observe wandering ameiboid cells with extended pseudopodia adjacent to the capillaries. Superficially, these appear in some respects comparable to those described as Rouget cells. They are not, however, permanently associated with the capillaries and do not represent their contractile mechanism.

Our observations on the capillaries of *Nereis* support the theory of Clark and Clark and of Federighi that "in capillaries normal contraction waves are due to the active and independent contractility of the endothelium" rather than to isolated Rouget cells.

Large blood vessels of *Nereis* possess isolated muscle cells which undoubtedly represent the chief contractile element of these vessels.

135. NOTES ON THE CYTOLOGY OF ENDOCHONDRAL BONE FORMATION IN *MUS NORVEGICUS ALBINUS*. Frances Louise Smith, State University of Iowa. (Introduced by H. W. Beams.)

The characteristic rows of cells found in cartilage during the process of endochondral bone formation are formed by the division of the cells in a plane perpendicular to the long axis of the bone with a subsequent growth of one above the other in the opposite plane.

The Golgi apparatus of the perichondrial cells is a reticulum polarized in either end of the cell. In the unchanged cartilage cells the Golgi apparatus assumes a net-like form and is apparently polarized at any point along the surface of the nucleus. In the flattened cells of the cartilage rows the Golgi filament is finer and ramifies over the nuclear surface. Finally in the hypertrophied cells the Golgi apparatus becomes fragmentary and ultimately disintegrates with the cells.

Osteoblasts contain a net-like Golgi apparatus and small rod-shaped mitochondria. These do not change appreciably in form as the cells become embedded in the calcareous matrix. However, along the line of degenerating cartilage there are cells which resemble osteoblasts with the exception that they possess a coarser

type of Golgi apparatus which forms a network around the nucleus. These cells have been found lying adjacent to one another, some apparently in the act of fusing, thus giving rise to osteoclasts. Regardless of the number of nuclei in the osteoclast, each retains the characteristic Golgi apparatus of the osteoblast-like cells.

136. GERM CELL ORIGIN AND SPERMATOGENESIS IN THE SIAMESE FIGHTING FISH, *BETTA SPLENDENS*. Neville L. Bennington, Northwestern University. (Introduced by C. L. Turner.)

The breeding habits, number of offspring, size, colors and color patterns of *Betta splendens* indicate that this fish would be a suitable form for genetic investigations.

A study of the spermatogenesis has been made while breeding experiments were being carried out. The results of the cytological study are as follows:

1. 'Giant cells' are found scattered throughout the connective tissue stroma of all testes studied. These cells are comparable to cells found on the yolk sac of the embryo, both in size and structure. Each 'giant cell' by a series of divisions gives rise to a cyst of spermatogonia. Cell walls are not evident in the early stages of cyst formation.

2. The leptotene threads become massed together in a conspicuous synzesis. The pachytene threads arise from the contraction figure as heavy loops. Each pachytene thread contracts to form a tetrad. The irregular outline of the tetrad soon gives way to a chromosome of smooth contour.

3. Twenty-one chromosomes have been counted in the primary spermatocyte metaphase. These chromosomes are not all of the same size. Three chromosomes in particular are much larger than the rest.

4. Marked precession in one chromosome during the first spermatocyte division suggests that this element may be a sex chromosome.

137. GERM CELL ORIGIN AND GONAD DIFFERENTIATION IN THE VIVIPAROUS TOP MINNOW, *LEBISTES RETICULATUS*. Glenn C. Dildine, Northwestern University. (Introduced by C. L. Turner.)

In *Lebistes*, primordial germ cells first appear as giant cells in the primary endoderm. Definitive gut formation pushes these cells into the region of the dorsal mesentery. They then segregate into two longitudinal germinal ridges below the excretory tubes. Here they divide to produce gonia. From 10 to 15 days before birth some ovogonia undergo synapsis. At birth the paired ovaries contain ovogonia, enlarging ovocytes, and some stroma, while young testes show only primary spermatogonia and stroma. From 1 to 3 weeks after birth, the paired ovaries fuse to form a single gonad enclosing the ovarian cavity which connects directly to the oviduct. Ovocytes continue to enlarge, their nuclei becoming more diffuse. Maturity results about 3 months after birth. During the first 3 weeks after birth, spermatogonia increase in number and segregate into cysts, spermatid tubules arise from stroma, and the two juvenile testes partially fuse. About a month after birth, many of the primary spermatogonia divide to form cysts of smaller denser secondary gonia. Spermatogenesis follows, and ripe sperm appear at sexual maturity some 3 months after birth. Definitive germ cells in both sexes are traced in a continuous line from the primordial giant cells.

138. THE CHROMOSOMES DURING THE SPERMATOGENESIS OF TWO SPECIES OF XIPHOPHORUS, OF PLATYPOECILUS MACULATUS AND OF XIPHOPHORUS-PLATYPOECILUS HYBRIDS. E. M. Ralston, Northwestern University. (Introduced by C. L. Turner.)

During the spermatogonial stages in *Xiphophorus* and *Platyoeilus* and in the hybrid, two distinct types of cells are observed, a large lightly staining primary spermatogonium and a smaller deeply staining secondary spermatogonium. The chromosomes of the primary gonad of *Platyoeilus* differ somewhat from those of *Xiphophorus helleri* and *Xiphophorus jalapa*, but are very similar to those of the hybrid at this stage.

The chromosomes of *Xiphophorus* at this stage are long and thin, while those of *Platyoeilus* and of the hybrid are somewhat short and thick. The visible chromosome differences appear only during the primary spermatogonial stages.

The haploid group of chromosomes, numbering twenty-four in the hybrid, so resembles that of *Xiphophorus* and of *Platyoeilus* in both number and morphological characteristics during the primary spermatocyte division as to be practically indistinguishable from either. The persistent lagging of one large chromosome as it comes upon the equatorial plate during the primary spermatocyte division is very noticeable. The precocious division of this chromosome and the advancing of its two daughter components to the poles of the spindle in advance of the other chromosomes indicates that this chromosome may be a sex chromosome. The fact that the two daughter components are identical morphologically and that each secondary spermatocyte receives one of them suggests that the male in *Xiphophorus* and in *Platyoeilus* is homogametic.

139. CHROMOSOMES OF TWO SPECIES OF GRILLIDAE: ORTHOPTERA. R. L. King and H. W. Beams, State University of Iowa.

The members of the family Gryllidae have been relatively neglected so far as chromosome studies are concerned until the recent work of Honda and of Ohmachi. We have studied the spermatogenesis of *Hapithus agitator* and of *Orocharis saltator* belonging to the subfamily Eneopterinae. The chromosomes of these two species are very similar: both have thirteen chromosomes in spermatogonial metaphases; the eleven larger chromosomes, including the accessory, are atelomitic and the two smaller ones telomitic. There are six tetrads (five *Stenobothrus* type and one *Hippiscus* type) and the V-shaped accessory in the first spermatocytes. Second spermatocytes are of the two expected classes: one with six chromosomes and the other with seven.

140. SOMATIC SYNAPSIS IN CHIRONOMUS. R. L. King and H. W. Beams, State University of Iowa.

Balbani described the chromatin of the cells of the salivary glands of *Chironomus* larvae as a series of discs, embedded in a single convoluted thread which breaks down into several shorter or longer pieces in older larvae. Balbani observed occasional points where the thread forks into two for a short distance. Alveredes described the origin of the single thread from a double spiral and explains the later double condition as a persistence of the original

double spiral. The double spiral in cells of other forms is usually considered as the result of the splitting of the chromosomes preparatory to the next division but Alveredes considers that this explanation is not valid in this material since no mitoses are found. We have examined the cells of the salivary glands of *Chironomus* sp. and have found that there are regularly four segments (chromosomes) present. Two of these chromosomes may be distinguished from the others and identified in other cells of the same and of different individuals. One of the chromosomes is small, usually marked by a plasmosome and double at one end; the other is very large and marked by a conspicuous plasmosome. Since Hasper has reported the haploid number of chromosomes in *Chironomus* as four, it seems probable that we have here a case of somatic synapsis so common in the Diptera. However, that condition here is extreme, since the pairs in somatic synapsis usually seem "to lie specially close together, although still never touching."

141. A METHOD FOR THE QUALITATIVE ANALYSIS OF THE CHROMOSOMES OF *DROSOPHILA MELANOGASTER*. T. S. Painter, University of Texas.

A method has been developed by which one can separate out single chromosomes from the salivary glands and study their morphology. It has been found: 1) That each chromosome is more or less segmented in character, each segment having a definite and often a very striking pattern of lines and bands which, in general, is constant to an extraordinary degree. Thus we cannot only identify the same element in different larvae, but a definite segment, a part thereof, even though its position has been changed by some form of dislocation. 2) In old larvae homologous chromosomes undergo an intimate somatic synapsis during which they pair in the most exact way. If one chromosome is deficient, its mate pairs with it except at the deficient area where the normal buckles. If one homologue carries an inversion, we get typical inversion figures such as we would expect to find in meiosis. Larvae heterozygous for mutual translocations show rings or chains of chromosomes. 3) All chromosomes are embedded, at the spindle fiber end, in a sort of coagulum. The two arms of the large autosomes have no obvious connection. Thus, after somatic synapsis, there are six elements in nuclei, i.e., the paired Xs, IVs, and the right and left arms respectively of the IIs and IIIs. The method opens up to direct attack many cytological and genetic problems.

142. EFFECTS OF CENTRIFUGAL FORCE ON THE ECTOPLASMIC LAYER, NUCLEI AND CLEAVAGE OF FERTILIZED SEA URCHIN EGGS. Ethel Browne Harvey, Princeton University.

The ectoplasmic layer of *Paracentrotus lividus*, *Parechinus microtuberculatus* and *Sphaerechinus granularis* can be thrown down by centrifugal force as a ring which lies in the perivitelline space. When eggs kept in Ca-free sea water are centrifuged, the ring is not thrown down, but when returned to sea water, the ectoplasmic material is precipitated as small refringent granules in the perivitelline space.

If centrifuged before or during the monaster stage, the pronuclei can be separated, the female going to the light pole and the male to the heavy pole.

In greatly elongated eggs, during the time that the male nucleus is approaching the female, it may enlarge so as to become three times the volume of the female. In eggs separated into two parts, one may contain the female and the other the male nucleus. In most cases, the female nucleus forms a monaster, and the fragment does not divide; the male nucleus forms an amphiaster and this fragment divides normally. In a few cases, the part with the female nucleus divided normally and the part with the male nucleus did not divide, the male nucleus grew smaller and disappeared.

If centrifuged during the amphiaster stage, oil drops are caught in the astral fibers while passing to the centripetal pole; the mitotic figure is thrown under the oil cap. If centrifuged a short time before cleavage, the cleavage plane comes in perpendicular to the stratification. If centrifuged immediately before (or during) cleavage, the cleavage plane may come in (or complete itself) parallel with the stratification and consequently in a plane bearing no relation to the new position of the spindle.

143. POLYOVULAR FOLLICLES IN THE OVARY OF A YOUNG CAT. Pauline H. Dederer, Connecticut College.

An additional instance is presented of the occurrence of polyovular follicles in the cat, previously described by Hartman and others.

In nearly complete serial sections of one ovary, at least eighteen follicles were found to contain two ova; a few contained three ova. In the other ovary (sections incomplete) there were noted nine biovular follicles, two triovular, and two follicles containing five ova.

The stages of development range from young growing follicles with no fluid space to those with a considerable accumulation of fluid. In young follicles the ova may be separated by the zona pellucida of each ovum, or by one or two layers of follicle cells. In older follicles each ovum, with its own cumulus oophorus, is quite widely distant from the other ovum or ova in the follicle. The position of the older follicles, in or near the medulla of the ovary, indicates that none were mature.

As noted by Hartman and others, the ova of a given follicle are in the same stage of development. There is no evidence as to their fate.

144. THE EFFECT OF TEMPERATURE ON OSMICATED FATS AND GOLGI APPARATUS IN LIVER CELLS OF FISH. Ross C. McCardle, Brown University and Temple University. (Introduced by Secretary of the Society.)

While experimenting to show the effect of increased temperature on mitochondria in liver cells of *Carassius auratus*, observations were made on osmicated fats and Golgi apparatus. Animals were subjected to temperatures varying from 25° to 55°C. for varying lengths of time. A state of heat rigor occurred at about 38°C. Preparations from osmicated (2 per cent osmic acid) tissue, and from frozen and formalin fixed tissue stained with sudan III or Nile blue sulphate were studied.

Normal hepatic cells osmicated 14 days show the Golgi apparatus as a heavily blackened reticulum near the nucleus, with few blackened fat (?) globules. After staining with sudan III few fat globules appear. Nile blue sulphate produces a faint blue coloration.

During early stages of heat rigor (37.5°C.) the Golgi reticulum becomes enormously swollen, sometimes filling the whole cytoplasm. After treatment with higher temperatures (39° to 40°C.), it apparently breaks into many small heavily blackened rods (dictyosomes?). After application of lethal temperatures (55° and 60°C.), the Golgi apparatus appears as many small granules with occasional rods. These granules may correspond to the 'vacuome.' Both osmicated fat globules and those stainable with sudan III are extremely numerous in these apparently dead cells. Nile blue sulphate stains the cytoplasm purple.

During heat rigor and death the Golgi apparatus becomes swollen and broken into rods and granules which migrate to the peripheral cytoplasm. It is difficult to determine whether this process involves direct solvent action of heat or some chemical alteration which renders the Golgi substance more soluble in the cellular fluid.

PROTOZOOLOGY

Read

145. *DIFFLUGIA CRATERA* LEIDY, A CILIATE. Stephen R. Williams, Miami University. (Lantern; 7 min.)

In the monograph on 'The Rhizopods of North America' by Prof. Joseph Leidy, one finds pictures (pl. 12, figs. 19, 20, 21, and pl. 16, fig. 35) of a diffugia-like shell from Bucks County, Pa., and from Lake Erie at Buffalo which he named *Diffugia cratera*. *Diffugia cratera* Leidy is listed in Landacre's 'Protozoa of Sandusky Bay.'

Some years ago, at the Stone Laboratory of the Ohio State University at Put-in-Bay, while studying material brought in for class use, I was surprised to see one of these small diffugia-like shells put forth a ring of cilia instead of pseudopods and swim actively away.

On looking up the description of the creature I found that Doctor Leidy must have had doubts concerning his classification, for both on page 109 of the text and in the description of the figures on plate 12, he says, "Since describing these minute forms I have suspected that they belong to a ciliate infusorian of the genus *Tintinnus*."

Comparing Leidy's figures with those of Kent and of Butschli, I conclude that the animal must be *Codonella lagenula*, Claparede and Lachmann, family Tintinnidae.

146. FERMENTATION OF CARBOHYDRATES BY *COLPIDIUM*, AND EFFECTS OF CARBOHYDRATES ON GROWTH. Alfred M. Elliott, New York University. (Introduced by R. P. Hall.) (Lantern; 10 min.)

A comparison of the effects of fifteen carbohydrates on growth of *Colpidium striatum* and *C. campylum* showed that growth of the latter is accelerated by eleven; that of *C. striatum* by only six. In fermentation tests with Difco phenol-red broth, both species fermented dextrose, levulose, mannose and starch readily; *C. campylum*, in addition, produced rapid fermentation of maltose. In further tests in weakly buffered media, both species were found to ferment dextrin slowly, and *C. striatum* produced slow fermentation of maltose. Fer-

mentation reactions establish definite differences between the genera *Colpidium* and *Glaucoma* (Colas-Beleour and Lwoff, '25). The pH of the medium is related to the accelerating effects of carbohydrates on growth of *Colpidium*, maximum acceleration appearing below pH 7.0 (in the range 4.9 to 6.5), while little or no acceleration was observed above pH 7.0. The addition of insulin to galactose, dextrose and levulose media decreased growth rate of both species, but produced no effect on growth in sugar-free media.

147. THE FATE OF DIFFERENTIATED ORGANELLES IN THE DIVISION PROCESS OF DEVESCOVINID FLAGELLATES. Harold Kirby, University of California. (Lantern; 10 min.)

Detailed studies of division in seven species of devescovinids in six genera, together with consideration of stages in many other species and of published reports, indicate essential agreement in all devescovinids. The four original flagella are retained, new ones developing to complete the number. The new trailing flagellum usually does not reach full size before plasmotomy. The blepharoplasts may originally be several separate granules, some large. They become a small compact group or single granule. The old cresta is resorbed, and there is early differentiation of new ones. The proximal part of the parabasal, usually for about nuclear length, is retained. A new one differentiates to equal size, then both grow equally. The detached part of the parabasal is resorbed. The old axostyle is resorbed, the capitulum early, the trunk usually persisting until late. Two new axostyles grow, numerous small cytoplasmic granules accumulating on them meanwhile. The ends of the paradesmose are connected by short filaments to the blepharoplasts. The ends, while in size like the rest, often stain deeply, appearing as granules suggesting centrioles. The paradesmose greatly elongates, especially after nuclear division, by growth, not merely drawing out. Its remnants persist along the axostyles for a time after plasmotomy. The mastigonts migrate to opposite ends of the rounded body, with the posterior end of each axostyle near the opposite nucleus. The body then elongates and divides at the equator. Reorganization usually is not completed until after plasmotomy. Double individuals, however, with nuclei close together, have completely reorganized mastigonts.

148. THE RELATION OF THE NUCLEUS TO AMOEBOID MOVEMENT IN *AMOEBA DUBIA*. Robert Chambers, New York University (5 min.)

An active ameba, impaled on a microneedle against the surface of a coverslip in a hanging drop, rapidly releases itself by flowing away from the needle. If the tip of the needle pierces an inclusion body in the ameba, e.g., an ingested rotifer, the flowing movements of the ameba result finally in the discarding of the inclusion together with the needle. If, on the other hand, the nucleus is impaled the amoeboid movements are never continued in one direction long enough to carry the ameba away from the needle.

By title

149. HOST-PARASITE SPECIFICITY IN THE GENUS *BALANTIDIUM*. Robert Hegner, Johns Hopkins University.

The members of this genus of large ciliates live in man, apes, monkeys, pigs, and many other animals. Attempts have been made to determine host-parasite specificity among them by cytological studies and cross-infection experiments. Comparisons of the size and shape of the body and the size and shape of the macronucleus were found to be helpful in separating species. Using these features as criteria, it was impossible to separate specifically the balantidia of man, chimpanzee and the coli type from the pig. The presence of a second species, *B. suis*, in the pig is not yet certain. The *Balantidium* from the guinea-pig is a distinct species, *B. caviae*; that from the rhesus monkey is also a distinct species, *B. simile*. Six new species are described from monkeys, camel, opossum and ostrich. Since *Balantidium* feeds largely on starch grains, resistance to infection in a foreign host may be overcome by a diet high in carbohydrates. This has been done in the case of the rat, which can be infected readily with balantidia from the pig and chimpanzee, if fed on a high carbohydrate diet. Failure of rats and many other animals to become infected in nature with *Balantidium* from various hosts may be due to this single factor—diet. Host-parasite specificity in this genus appears, therefore, to depend largely on the diet of the host.

150. CILIATES FROM BERMUDA SEA URCHINS. Miriam Scott Lucas, Washington University.

Two species of the genus *Metopus* occur among other ciliates in the intestinal lumina of Bermuda Island sea urchins. One species, *Metopus cucumlabens*, has formed the basis for a cytological study of the neuromotor system. The pharyngeal strand which in *Metopus* has reached a prominent state of development is perhaps the element most suggestive of theoretical consideration. A general morphological study of this ciliate is included.

151. THE TROPHIC NATURE OF *CHLOROGONIUM* AND *CHILOMONAS*. John B. Loefer, New York University. (Introduced by R. P. Hall.)

Completely autotrophic nutrition of *Chlorogonium euchlorum* and *C. elongatum* has been demonstrated by growing the organisms bacteria-free in a medium containing NH_4NO_3 , KH_2PO_4 , MgSO_4 , NaCl , FeCl_3 (pH 7.0) for more than 2 years, transfers to fresh media being made at monthly intervals. Comparative growth, determined by the Sedgwick-Rafter counting-cell method, indicates that nitrates and ammonium salts are utilized to equal advantage as nitrogen sources by both species. The same strains have been grown in darkness for 50 weeks, without etiolation, in a solution of salts to which sodium acetate, dextrose and Difco proteose-peptone were added, indicating that both species are capable of continued heterotrophic growth.

All attempts to grow *Chilomonas paramecium* in a sterile autotrophic medium failed. In a mineral medium containing sodium acetate (0.2 per cent), a certain amount of growth occurred in the first, second and third subcultures after 5-day

periods. Such growth was probably due to the small amount of organic nitrogen introduced with the inoculum in making the transfers. In no case was growth observed after the third transfer, even when sodium silicate (0.05 to 0.1 per cent) was added to the medium. Autotrophic growth of *Chlorogonium* was not accelerated by sodium silicate.

152. GROWTH OF *COLPIDIUM CAMPYLODITUM* WITH REFERENCE TO OXYGEN RELATIONSHIPS. R. P. Hall, New York University.

Growth of *Colpidium campyloditum* in a peptone medium and in peptone medium plus dextrose was compared in aerobic culture and a modification of the Buchner anaerobic culture method. In peptone medium, growth was reduced approximately 50 per cent in the 'anaerobic' tubes as compared with the aerobic controls. In peptone medium plus dextrose, growth was slightly greater (approximately 10 per cent) in the 'anaerobic' tubes than in the aerobic tubes; in each case, growth in the medium containing dextrose was greater than in the aerobic tubes of peptone medium. The results suggest a similarity in respiratory metabolism between *Colpidium campyloditum* and the facultative anaerobes among the bacteria.

153. EFFECTS OF SALTS OF CERTAIN FATTY ACIDS ON GROWTH OF *CHILOMONAS* AND *CHLOROGONIUM*. John B. Loefer, New York University. (Introduced by R. P. Hall.)

The sodium salts of acetic, propionic, butyric, isobutyric, valeric and caproic acids (0.3 per cent concentration), respectively, in a tryptone (0.3 per cent) and inorganic salt medium increased growth of three species of flagellates. After 45 hours of incubation, *Chilomonas paramecium* showed the following x/x_0 values (ratio of final to initial count): acetate, 568; butyrate, 398; valerate, 307; propionate, 165; isobutyrate, 101; caproate, toxic; tryptone control, 52. Results for *Chlorogonium euchlorum* after 45 hours were: acetate, 1074; butyrate, 669; valerate, 197; propionate, toxic; isobutyrate, 98; caproate, toxic; tryptone control, 37. Similar results were obtained with *C. elongatum*, propionate again proving toxic instead of accelerating growth as in *Chilomonas*.

154. EFFECTS OF CERTAIN ORGANIC ACIDS AND PROTEIN DERIVATIVES ON THE GROWTH OF *COLPIDIUM*. Alfred M. Elliott, New York University. (Introduced by R. P. Hall.)

In studying the nitrogen requirements of *Colpidium striatum* and *C. campyloditum* it was determined that single amino acids are unsatisfactory, while proteins and partially hydrolyzed products of proteins serve as excellent sources of nitrogen. Of the five Difco peptones tested, those containing relatively high percentages of amino acids were superior to those low in this form of nitrogen. While the growth range (pH 4.0 to 8.6) and zone of maximum growth (pH 5.5 to 6.5) remained rather constant in various peptone and protein media, the type of growth curve (bi- or unimaximal) depends upon the type of protein or peptone employed.

Sodium salts of the five lower fatty acids, and of citric acid, proved lethal to both species at pH 5.8, while glycollate, pyruvate and tartrate were moderately toxic. Growth in relation to pH in acetate and butyrate media showed that the former substance accelerates growth at pH 6.5 to 7.0 for *C. striatum*, and at 7.0 for *C. campylum*. Butyrate accelerated growth of both species above pH 7.0. Below these pH values toxic effects were evident.

155. BACTERIA-FREE CULTURES OF *ASTASIA* SPP.; THE STRUCTURE AND TAXONOMIC POSITION OF *ASTASIA* *OCCELLATA* (= *EUGLENA* *QUARTANA*?). Theo. L. Jahn, Yale University.

Astasia ocellata (= *Euglena quartana*?) and *Astasia* sp. have been isolated with the aid of small pipettes, washed free from bacteria, and grown in bacteria-free culture in depression slides. The medium used was 1 per cent hydrolyzed casein plus 0.1 per cent potassium phosphate at pH 7.0. The growth rate is about one division per day.

The *Astasiidae* possess a single non-bifurcated flagellum; the *Euglenidae* a single flagellum bifurcated at the base and bearing a swelling near the point of bifurcation (Hall and Jahn, '29). *Astasia ocellata* and *Euglena quartana* are colorless and have a stigma, but heretofore descriptions of their flagellar insertions have been lacking. A species has been observed which fits the descriptions of *A. ocellata* Khawkin and *E. quartana* Moroff, and these two species are possibly synonyms. Specimens prepared by iron-haematoxylin and Kolatchev methods show that the flagellum is bifurcated and bears a swelling as in the family *Euglenidae*. The stigma is composed of numerous orange-red granules arranged in a plaque as described for species of *Euglena*. These findings point to the probability that the organism is not closely related to non-stigma-bearing species of *Astasia*, and that it should be regarded as a colorless species of *Euglena*. This suggestion was made previously by Hall and Jahn ('29), but at that time the organism was not available for study of flagellar insertion.

PARASITOLOGY

Read

156. FROGS AND THEIR OPALINID COMMENSALS. Maynard M. Metcalf (15 min.)

Attention is directed to a paper in the hands of the editor for the United States National Museum which discusses data and uses methods indicating: geologic times and places of origin and routes and times of spreading of the families of Anura (excepting *Gastrophrynidae*), of some subfamilies, several genera, and a few species; and also of all genera, some subgenera and many species of the *Opalinidae*. Such a comprehensive study from this point of view has not before been undertaken for any groups of animals. It covers data from the Triassic period to the present time. The present paper is a brief summary listing the paleogeographic hypotheses (generally proposed by students in that field). It mentions the sorts of data used and gives a few illustrations of the methods of using these data and of some of the types of conclusions reached. This brief paper is to be published promptly. The publication of the National

Museum paper has been delayed a year and a half by lack of appropriation to the Museum for publication and will be still further delayed. Almost complete lack of anuran fossils does not prevent conclusions gathered from the abundant, varied and intricately interwoven data as to the hosts' family and their commensals. Both the larger and this brief paper emphasize the sorts of data which are usable and the methods of using them.

157. SOME STUDIES ON NORTH AMERICAN LARVAL TREMATODES. E. L. Miller, Louisiana State University. (Introduced by William H. Gates.) (10 min.)

Correlations of the results of detailed studies on twenty-three larval trematodes while at the University of Illinois show that certain larval structures, such as the position of the penetration glands, shape of the bladder, branching of the excretory system, shape and size of the stylet, and the character of the germinal mass, are of more importance in showing subgroup relationships, rather than for specific diagnoses.

The character of the excretory system may change, due to division of flame cells and growth of tubules and capillaries, and even a ventral sucker may appear during the metacercarial stage (McCoy, '29). The above facts must be carefully considered if we are to progress toward the use of dependable characters of cercariae for specific diagnosis.

Other observations lead to the belief that cercariae emerge prematurely from mollusks kept under abnormally high temperatures, death consequently resulting. This may explain why many hosts remain uninfected during experimental life history studies of cercariae.

Examinations of cercariae from a collection of nearly 4000 molluscs collected over a period of 3 years revealed the fact that many species of cercariae inhabit several different species and genera of hosts. In fact the very existence of many forms depends upon their cosmopolitan adjustment to various hosts in different localities.

This study includes descriptions of fifteen new species of cercariae, eight of them from Illinois. The thirty-eight Illinois forms have been arranged in a key for convenience in identification.

By demonstration

158. A NEW PARASITIC CIRRIPEDE (CRINOIDOXENOS HALOCYPRIS). Charles H. Blake, Massachusetts Institute of Technology.

This new genus (parasitic on a crinoid) is apparently the most primitive existing cirripepe, since the adult is a true cypris 'larva.' The so-called antennal glands persist. The ventral sucker is unique.

By title

159. NEW TREMATODES FROM LOUISIANA REPTILES. H. J. Bennett, Louisiana State University. (Introduced by William H. Gates.)

The trematodes described were collected from reptiles found at Baton Rouge, Louisiana.

Protenes vitillosus nov. sp. Host: *Pseudemys elegans*. Habitat: Small intestine.

P. vitillosus is compared to *P. leptus*, Barker and Covey ('11), the species most similar to it. A generic diagnosis and a key to the species is given.

Cercorchis singularis nov. sp. Host: *Pseudemys elegans* and *Cheyldra serpentina*. Habitat: Small intestine.

C. singularis is compared to *C. robustus* Goldberger ('11). The writer accepts *Cercorchis* as a separate genus.

Neochasmus labeosus nov. sp. Host: *Natrix rhombifera*. Habitat: Small intestine.

This is the second species described in the genus. The subfamily and generic diagnosis as given by Van Cleave and Mueller ('32) are emended.

Megacustis multispinosus nov. gen. and nov. sp. Host: *Anolis carolinensis*. Habitat: Small intestine.

M. multispinosus belongs in the family Plagiorchidae as defined by Fuhrmann ('28) and in the subfamily Lepodermatinae as emended by Mehra ('30). It is compared to three closely related genera, *Haplometroides* Odhner ('11), *Spinometra* Mehra ('32) and *Microderma* Mehra ('32).

Type material deposited in the Ward Helminthological Collection, University of Illinois, Urbana, Illinois.

160. OBSERVATIONS ON THE TREMATODE FAUNA OF DEEP-SEA FISHES OF TORTUGAS, FLORIDA. Harold W. Manter, University of Nebraska.

Examination of over 700 fishes (including about eighty-five species) from depths of 40 to 582 fathoms at Tortugas showed that approximately 80 per cent of host species and 30 per cent of individuals are infected with trematodes. This degree of infection is approximately the same as for shallow-water fishes and there is no indication of diminution in the trematode population at any of the depths sampled. The trematodes collected indicate a distinctive fauna especially as compared with shallow-water trematodes of Tortugas. Of forty-eight species of digenetic trematodes collected, thirty-four seem to be new. Numbers of examinations being approximately equal at different depths to 300 fathoms, the bathymetric distribution of some common species may be demonstrated showing a fairly definite upper limit and usually a less definite lower limit. A few species seem to be limited to intermediate depths above which or below which they were not found.

Seven species, exclusively deep-water at Tortugas, are identified as identical with trematodes reported from surface waters of northern regions and a number of other species find close relatives in far distant waters. As a result, the deep-water trematode fauna shows more resemblance to that of remote, cold waters than it does to nearby, warm waters. A thorough survey of surface waters at Tortugas reveals only two species of trematodes also occurring below 100 fathoms.

161. *GYRODACTYLUS* AS A PARASITE OF THE TADPOLES OF *RANA CATESBEIANA*. H. W. Stunkard and F. W. Dunihue, New York University.

Species of *Gyrodactylus* have been described from many groups of fishes but apparently have not been reported previously from amphibians. Tadpoles of *Rana catesbeiana* collected in southern New Jersey were heavily infected by a species of *Gyrodactylus*. The parasites occur over the entire surface of the

body but are most numerous on the tail fins, particularly at their junction with the median portion of the tail. The worms feed on the epidermis and portions of the tail may be almost denuded.

The average length of living specimens is from 0.2 to 0.5 mm. The two great hooks measure about 0.06 mm. in length and have cuticular accessory pieces. The proximal transverse clamp of these hooks is shaped like a bow with a thickened portion near the middle. The more distal clamp bears a flat brush-like projection. Further studies may show these specimens to belong to a new species.

162. FURTHER STUDIES ON TRYPANOSOMIASIS IN THE CANARY. Reginald D. Manwell, Syracuse University.

As the result of further study of trypanosome infections in the canary (due to a type closely resembling *Trypanosoma paddae*, Laveran and Mesnil ('04), but differing from it in certain particulars) it has been definitely determined that this type of infection is self-limited. After the initial patent stage, which usually lasts only a few days—often only a day—relapses may occur at irregular intervals for several weeks, but after that no recurrences have been observed. This makes it quite certain that there is no seasonal variation, at least in the canary, as has been suggested by certain others. Attempts to culture the parasite from old cases (of about a year's duration), and to produce infections in fresh birds by intraperitoneal inoculation of massive doses of blood from such cases have both been futile.

Division of the parasites does not seem to occur in the circulating blood, since careful and prolonged search of many smears has so far failed to reveal a single dividing individual. Great variation in form has been noted, however, and in this respect this trypanosome is like other avian types. This variation is so great that studies made from the same case at different times during the course of the infection might easily be thought to show different species. This suggests that descriptions of new species are very untrustworthy in the case of avian trypanosomes, unless made from a prolonged study of one or a series of cases. Many species have been described in the past from parasites seen in single smears.

In certain cases it has been possible to graph the changes in size exhibited by the parasites at different stages in the infection, but it seems unlikely that any such inhibition of reproduction occurs as in *Trypanosoma lewisii* infections, and there is evidence that a trypanolytic crisis occurs at the height of the infection.

163. FURTHER OBSERVATIONS ON THE LIFE CYCLE OF *CERCARIAEUM LINTONI*. H. W. Stunkard, New York University.

During the past summer attempts were continued to discover the life cycle and secure sexually mature stages of the trematode whose larva, *Cercariaeum lintoni*, was described from *Nassa obsoleta* by Linton ('15) and subsequently studied by Miller and Northup ('26), Africa ('30) and Shaw ('33). Shaw found that the larvae encyst in the parapodia of *Nereis virens* and develop there to the metacercarial stage. In the present experiments large numbers of *Nereis* were exposed to the larvae until from 1000 to 5000 of them were encysted in the parapodia of each *Nereis*. After a developmental period of from 2 to 3 weeks

in *Nereis* the worms were fed to different species of fish. Attempts to infect *Tautoglabrus adspersus*, *Spheroides maculatus*, *Prionotus carolinus* and *P. strigatus* were unsuccessful. The fishes were dissected 24 hours after feeding and no young worms were found. Encysted metacercariae and young worms were recovered from the intestines of *Paralichthys dentatus* and *Tautoga onitis*, while sexually mature specimens were obtained from *Anguilla chrysypa* and *Opsanus tau*. Since no natural infection by this species was found in either the eel or toadfish, it is possible that neither of these species is the natural host.

164. A TEMPERATURE REACTION IN A COLD-BLOODED ANIMAL. C. T. Hurst and C. R. Walker, Western State College of Colorado.

In some former work of the writer (Univ. Calif. Publ. Zoöl., vol. 29, no. 14) it was shown that the snail infected with the larval stages of the trematode worm uses more oxygen than a healthy one. The process of metabolism then must go on more rapidly in the diseased snail. This is what one would expect, since a similar thing occurs in warm-blooded animals. The latter type of animal suffers a very definite fever reaction.

The question was raised as to whether or not a similar reaction occurs in the cold-blooded animal. The normal aquatic snail has a temperature but slightly above that of the surrounding water. In the case of the snail (*Lymnaea stagnalis*) used in the experiments herein described this amounts to only a few hundredths of a degree. Over eighty experiments were performed on both healthy and parasitized snails in a specially constructed apparatus and it was found that there is a definite increase in temperature in parasitism. The parasitized snails averaged a temperature increase above the surrounding medium of more than twice that of the normal ones.

The experiments were carried out with many precautions to prevent unreliable results. All controllable variable factors were rigidly taken care of. Some variable factors could not be so controlled.

MISCELLANEOUS

Read

165. NATURAL HISTORY OF THE FOUR-TOED SALAMANDER, *HEMIDACTYLUM SCUTATUM* (SCHLEGEL). Frank N. Blanchard, University of Michigan. (Lantern; 15 min.)

The four-toed salamander tends to hibernate in association with others of its kind and with other small salamanders and frogs of its habitat, often in rather superficial situations.

Since mating is an autumn event in this species, the spring breeding migration involves only the females that have eggs to lay. As soon as the weather is sufficiently warm to thaw the ground well, the females move to the water, enter and swim to a nesting site, climb out and wait a little while for the laying of eggs. From one to a dozen or more females may assemble in close association for egg-laying, but after all have deposited their eggs it is usual for only one or two females to remain with them.

In southern Michigan the eggs are laid from the middle to the last half of April. A few belated individuals deposit eggs in May.

The ordinary variation in number of eggs per female is from eighteen to forty-one. A female lays all her eggs in one nest. The average number of eggs produced by the females of a single habitat may vary significantly from one season to another. There may be much variation in the egg production between the two ovaries of a single female, but on the whole there is no demonstrable difference between left and right ovaries in this respect.

The sex ratio as determined from 600 juvenile specimens is 57.4 females to 42.6 males, plus or minus a probable error of 1.4.

166. SPADE-FOOT TOADS (*SCAPHIOPUS HOLBROOKII*) IN CONNECTICUT IN 1933. S. C. Ball, Yale University. (Lantern; 12 min.)

After heavy late winter rains several hundred spadefoot toads congregated in a temporary pool in the city of Ansonia. The first calls were heard April 1st, but the greatest activity occurred from April 15th to 18th, when the eggs were laid. All adults disappeared on the 19th. Another downpour on June 9th brought out many spadefoots at the same place. All had vanished next day without further oviposition. In a small West Haven pond a few egg masses were found April 22nd.

Excavations during the spring and summer at Ansonia uncovered spadefoots to a depth of 7 feet. Adults kept in out-of-door pens emerged nearly every night until October 1st.

The development and behavior of tadpoles and young toads were studied. Both are positively phototropic. In September, young which had attained a body length of 27 mm. on a diet of termites and *Drosophila* persistently sought the light when deprived of earth. Another in 20 minutes traveled 14 feet from shadow into sunlight, through grass and over a rock from which it captured eighteen minute harvest mites and a small beetle. Upon coming in contact with bare soil it immediately burrowed.

167. HEREDITY OF IMMUNE REACTIONS IN RABBITS. Clyde E. Keeler and W. E. Castle, Harvard University. (Lantern; 15 min.) (Also by demonstration.)

Twelve matings show the four immune blood groups to depend upon presence or absence of two agglutinogens (H_1 and H_2). These agglutinogens are dominant mendelizing characters of erythroplasts and early embryonic nucleolated normoblasts. Linkage tests show them to be independent of eight linkage groups of rabbits. There are sixteen possible types of blood transfer in adult rabbits, nine producing no agglutinins, six producing a single agglutinin, and one producing two agglutinins. Whether a blood transfer produces agglutinins, and the kind of agglutinin produced, depends upon the genetic constitution of both donor and recipient. The incubation period of agglutinin production is less than 2 weeks. The two agglutinins are borne upon independent molecules. The H_2 reaction is stronger than the H_1 reaction, and the reaction of cells heterozygous for an agglutinin is as strong as that of cells homozygous for the same agglutinin. There is no heterospecificity between agglutinins. Both agglutinins pass through the placenta, but fetuses can not elaborate agglutinins. Rabbits of proper genetic constitution under 8 months of age developed no agglutinins,

but all over 2 years of age produced them. The age at which a rabbit develops its capacity to elaborate agglutinins is probably independent of weight and sex maturity, and is probably a matter of individual constitution which may depend upon genetic factors. The possible effects upon embryos which have inherited from their fathers erythrocyte constitutions incompatible with agglutinins developed by their mothers are discussed.

168. THE PHYLOGENY OF THE CIRRIPIEDIA (BARNACLES). Charles H. Blake, Massachusetts Institute of Technology. (5 min.)

Three lines (at least) of descent may be traced. 1) the line of primitive parasites, represented by Synagoga, etc.; 2) the free-living, metamorphosing Thoracica; 3) the parasitic metamorphosing Rhizocephala. Lines 2 and 3 are more closely related to each other than either is to line 1.

169. LONGEVITY AND MAXIMUM GROWTH ARE INCOMPATIBLE. C. M. McCay and Mary F. Crowell, Cornell University. (Introduced by H. D. Reed.) (Lantern; 10 min.)

Modern practice in rearing animals assumes that optimum growth is maximum growth. Three years ago we began to test the hypothesis that a slowly growing animal will live longer than one maturing rapidly. At weaning time rats were divided into three groups, as nearly as possible equalized in regard to sex and litter mates.

A synthetic diet was used containing adequate amounts of all essential nutrients. Group I was allowed excess food, reaching maturity rapidly. Group II was retarded by a restriction of calory intake immediately after weaning. Group III was allowed a short period of rapid growth and then retarded as in group II.

At the end of 35 months only two animals were alive in group I, while nineteen were alive in the other groups. The mean length of life for the males in the three groups was, respectively, 535, 785, 900 days. Both slow-growing groups have attained life spans greater than those upon the best diets in Sherman's 'longevity' experiments.

These data indicate that the life span of animals can be extended far beyond what we term 'normal' by the control of growth through nutritional methods. The 'normal' for the rat must be a value inversely proportional to the growth rate. Since the males of the control group had shorter life spans than the females while those of the slow-growing groups were almost identical, we have a new explanation for the fact that the female of a species outlives the male.

170. EXPERIMENTAL DEMONSTRATION OF INTERNAL RESISTANCE AND POPULATION CYCLES. Royal N. Chapman, University of Hawaii. (Lantern; 15 min.)

The experimental study of animal populations stands in contrast to that based on the collection of population statistics and speculation as to the causes of fluctuations.

The continuation of the technique developed for handling populations of flour beetles, *Tribolium confusum* Duval, has led to the establishment of biotic constants, under certain conditions of temperature and humidity, with coefficients of variability which are comparable to those encountered in physical systems.

Four separate populations which have been carried on for nearly 2 years have shown synchronous fluctuations. In the state of quasi equilibrium the populations of pupae show cyclic fluctuations with the period and amplitude varying.

It has been possible to study the environmental resistance experimentally by setting up populations of adult beetles all of which are males, and then adding eggs at the same rate as if half of the population had been females laying at the normal rate. With the biotic potential of the population thus maintained, it is possible to vary the components of the population and measure their influence as internal resistance. This method indicates that certain fluctuations occur as the result of resistance within the population when external factors are constant.

171. THE CAUSES OF CERTAIN DISEASES IN SALMONOID FISHES AND THEIR CURE.

H. P. Kjerschow Agersborg, State of New Hampshire Department of Fisheries and Game. (15 min.)

1. A common disease among developing trout and salmon is the so-called 'white-spot' disease.' Its cause or cure has never been discovered before. It has been one of the many troubles which always beset 'fish culturists,' providential in nature. However, this disease is caused by using too little water in proportion to the number of embryos in the trough units. It consists in the coagulation of the yolk beneath the periblastic membrane of the yolk, and the destruction at the areas of contact between yolk sacs of different embryos, by subsequent bacterial invasion over the injured areas and ultimately the embryo dies. The diseases can be cured by doubling the water flowage.

2. Fungus pest in salmonoid fishes is also caused by using too little water. As known, the causative agent or organism is *Saprolegnia ferox*. If this fungus is washed off by chemical treatments, but the water flowage not increased, the fungus may take hold of the small intestine and kill off "perfectly healthy and fine fish." This stage of fungus pest I have called intestinal fungisitis. Its only cure is more pure water.

3. 'Pot-bellied' in chinook salmon is intestinal occlusion caused by too coarse feed. It may be cured by using finer food. This trouble is much less apt to develop in fish held in water with constant, low temperature, e.g., around 50 to 54°F.

172. SOCIAL RECONSTRUCTION BY HUMAN STERILIZATION. J. H. Landman, College of the City of New York. (Introduced by Secretary of Section F.) (15 min.)

Our country suffers today from an overproduction and an underconsumption of commodities, but also from a surplus reproduction of our population. One-fifth of the population of the United States today is surplus, a mass of people who are socially unadjusted or maladjusted and whom we can never altogether properly absorb into our social and economic life again. Among the inadequate people we find the mentally diseased, the dependents, the delinquents, the mentally deficient, the degenerates, and the infectious. Many of these people are of such inferior quality that we should never want to reincorporate them. What are the causes of this social pathology? Environmentalists and hereditists are divided on this question. Among the remedial measures recommended are birth control,

restrictive marriage laws, eugenic education, reorganization of our social and economic life, scientific breeding, painless peaceful death, institutionalization and human sterilization. The hereditists, however, have been more convincing of late, primarily by exaggerating the scientific findings of eugenics. It is a young science and hence much that is myth, fable or postulate passes for scientific fact. The scant scientific eugenic knowledge has been prostituted to justify ancestor worship, race superiority, snobbery, class distinction, intellectual aristocracy and race prejudice. It is this meager genuinely scientific knowledge of eugenics that constitutes justification for compulsory human sterilization. Nevertheless, twenty-seven States may legally practice human sterilization surgery in the United States today and about 15,000 individuals have already been sterilized under the onus of this legislation. The United States is the pioneer in this movement and is its leading advocate in the world. In 1928 Alberta, Canada, in 1929 Denmark, Finland, and the canton of Vaud, in Switzerland, and in 1932 Vera Cruz, Mexico, espoused the cause. Germany is the latest nation to adopt this social therapeutic agency. To what extent is this type of legislation justifiable?

173. WITHDRAWN.

174. THE GUARANTEE OF EVOLUTION IN NATURE. Henry J. Reynolds, Chicago.
(Introduced by the Secretary of Section F.) (15 min.)

These claims are made: To have evolution, four fundamentals must normally exist in nature, first, the formation of new characters; second, the perpetuation of new characters; third, the formation of 'progressive' types; fourth, the perpetuation of progressive types. The first is supplied by 'variation,' which is guaranteed by environmental oscillation. The second results from general environmental stability, for it is shown that types in which organism's own adaptiveness has been allowed to play its part in the forming are heritable, as long as the environment remains stable. The third is supplied by 'outcrossing,' and this is guaranteed by the normal promiscuity of the male in the sex relation. In this fundamental is found the 'origin of the fittest' (incipient evolution), and note that the 'origin' of the fittest naturally preceded the 'struggle' with the fittest (natural selection). The fourth is supplied by the tendency of 'like to mate with like,' which, also, it is shown, normally exists in nature. This factor tends to the fixity of type which guarantees the preponderance of the fit and the swamping of the weak. Here the screening out effect of natural selection serves as a contributing factor, but note, after the 'fittest' have been bred, born and evolved. Nineteen pages have been devoted to supporting these claims and two important factors hitherto unused in attempting to explain evolution have been added.

By demonstration

175. TEMPERATURE REACTIONS AND SKIN STRUCTURES IN A NORTHERN TOAD, *BUFO AMERICANUS*, AND A SOUTHERN TOAD, *BUFO VALLICEPS*. Ann H. Morgan and Virginia F. Babcock, Mount Holyoke College.

Toads of the northern species, *Bufo americanus*, and the southern species, *Bufo valliceps*, were subjected to the same conditions of temperature and moisture

and their reactions compared. Several tissues and organs of such individuals were studied, but no significant differences have yet been observed except in the skin.

Under all conditions (varying temperatures, indoors or outdoors) *B. americanus* always burrowed deeper than *B. valliceps*. Desiccation appeared to stimulate burrowing in both species, and desiccated individuals of *B. valliceps* dug deeper than normal ones. After immersion in water for 12 to 71 hours neither species burrowed during an observation period of 48 to 72 hours. Sudden exposure to cold also failed to stimulate burrowing in either species. *Bufo valliceps* became completely inactive after 30 hours' exposure to temperature of 6°C. and after 2 hours at 3°C., while *B. americanus* continued active after 44 hours at temperatures of 1.3°C. to 4°C.

In the skin of *B. valliceps* there are microscopic lymph chambers. Histological study of injected material indicated that these open into cutaneous lymph sacs. No such chambers are present in the skin of *B. americanus*. It is suggested that the lymph chambers of *B. valliceps* may have a part in its greater susceptibility to cold.

176. A RAPID HAEMATOXYLIN TECHNIQUE FOR ROUTINE USE. Elbert C. Cole, Williams College.

Tissue sections are affixed to slides with Mayer's albumen fixative, in the usual manner. Immediately after the removal of paraffin from them, the sections are covered with a pellicle of celloidin or of celluloid. This serves as a mechanical aid in holding the sections in place, and in no way interferes with staining or visibility. Slides are brought down a graded series of alcohol and into water. They are then placed on a special staining board to give full exposure to the air. Treatment with iron-alum mordant follows. Following this the excess mordant is washed off and the sections flooded with a solution of haematoxylin, freshly prepared from stock solution by the addition of water and secondary sodium phosphate. After a short period of staining, the slides are rinsed in water and the sections destained in acidulated water or in dilute mordant solution. Counter staining, dehydration, clearing, and mounting follow as usual. The advantages of this technique lie in the economy in the use of reagents and in the great saving of time. In routine work, the required operations, from the affixing of the sections to the slides to the addition of balsam and cover glass, may be completed in 2 hours or less.

177. MOTION PICTURES OF NORMAL AND CANCEROUS CELLS IN TISSUE CULTURE. Robert Chambers, New York University.

Three reels of pictures showing tissue culture technique; aspects of various normal cells in the mesentery and in tissue culture, and aspects of various cancerous cells in tissue culture. (To be shown Friday afternoon at a time to be announced later in Cambridge.)

By title

178. SELECTIVE INTRA VITAM STAINING OF SPECIFIC ELEMENTS IN THE INTEGUMENT OF THE SQUID. Elbert C. Cole, Williams College.

The capricious behavior of methylene blue, used intra-vitam, is too well known to require discussion. In organs where many kinds of tissue cells are intimately associated, methylene-blue pictures of similar tissue complexes may vary widely. The factors underlying this phenomenon are numerous and in part unknown. Certainly permeability and reduction-oxidation potential are important internal factors. Similarly, the concentration and composition of staining solutions, exposure to air, and the duration of the staining process are important external factors. The integument of the squid offers excellent material for the study of selective staining. In these experiments a temperature of 25 to 27°C. was maintained. Solutions used are slightly or moderately hypotonic. By variations in the tonicity of sea water, oxygen supply, and concentration of methylene blue, sodium hydroxide and potassium chlorate, it was found possible to secure the following variation in results: a) selectively stained connective tissue cells; b) fully expanded chromatophores, with radial muscles clearly stained; c) partially expanded chromatophores with radial muscles clearly stained; d) chromatophores with radial muscles lightly or not at all stained, but with their innervation clearly depicted. Composite results yielded much more information concerning the structure of the chromatophores than could be secured by a general staining of the integument, either with methylene blue or with haematoxylin. Similarly, the behavior of the chromatophores could be studied in those preparations in which the toxicity of the solution was maintained at a low level.

179. THE RIPENING OF HAEMATOKSYLIN. Elbert C. Cole, Williams College.

As soon as the ripening process, occurring spontaneously in haematoxylin solutions exposed to the air, was recognized as an oxidation phenomenon (Mayer, 1891), investigations in this field followed two general trends. One involved the search for a staining solution which, requiring no prolonged ripening, would be ready for use immediately after preparation. The second was concerned with the discovery of a staining solution in which the ripening process could be controlled and prolonged so as to give excellent results over a long period of time. Unfortunately, the two objectives are to some extent incompatible. In 1926 the writer published some data on this subject (*Science*, vol. 64, pp. 452-453). The present paper considers some of the author's modifications developed since that date, including the use of secondary sodium phosphate as a ripening agent. It also considers the value of sodium bicarbonate for this same purpose. The utility of sodium bicarbonate was reported by Hance, 1933, and was independently studied by the writer in the period following the appearance of the above mentioned paper in 1926.

180. COMPARATIVE STUDY OF THE BLOOD CELLS OF CAUDATE AMPHIBIA. R. M. Haff, Cornell University. (Introduced by Secretary of Section F.)

A comparative study has been made of the cells of the circulating blood of the following Urodeles: *Amblystoma maculatum*, and *tigrinum*, *Amphiuma* and *Cryptobranchus*.

Differences between the four species were observed in practically all cell types, with respect to either frequency, size or form of cell, or nuclear or cytoplasmic characteristics.

Bi-nucleated erythrocytes were observed in *Amblystoma tigrinum*, rarely in *maculatum*. Non-nucleated erythrocytes were seen in *tigrinum*. No basophilic leucocytes were seen in *Amblystoma maculatum* nor *Amphiuma* but they were rare in the other two forms.

Eosinophiles were found in all four species. In general the nucleus was pyknotic or darkly basophilic but in *Amphiuma* it was occasionally lightly basophilic, vesicular and nucleolated. No granular polymorphs were seen in any smear but many non-granulated cells with polymorphous nucleus were observed. This type of cell was rare in *Cryptobranchus*.

181. STUDY OF THE POST-EMBRYONIC GROWTH OF A HEREDITARY MELANOTIC NEOPLASM IN HYBRIDS BETWEEN TWO FISH-SPECIES. H. D. Reed, Myron Gordon and Winifred Lansing, Cornell University.

Four female platyfish (*Platypoecilus maculatus*) carrying the hereditary factor *Sp* for macromelanophores in the heterozygous condition when mated to males of Couch's platyfish (*Platypoecilus couchianus*) yielded 107 hybrid offspring in which melanosis developed, and 120 normal hybrids which exhibited no macromelanophores whatever.

In one cross where the sex linked factor *Sp* was carried on the Z chromosome of the mother ($W_{sp}Z_{sp}$) melanosis appeared in the hybrid males only. In three cases where the same factor was carried on the W chromosome ($W_{sp}Z_{sp}$) of the mother, melanosis appeared in all of the female hybrids and only three of the males. The males are interpreted as being cross over types receiving the *Sp* factor from their mother on the Z chromosome.

Only those fish which inherit the *Sp* factor for macromelanophores develop melanotic neoplasms.

The F_1 hybrids were inbred and they produced forty-nine normals and twenty-three melanotic individuals. In some of the melanotic fishes large neoplastic areas were present on the day of their birth.

In melanotic fishes the number of macromelanophores increase rapidly. They spread over the entire surface of the body. Growth of macromelanophores takes place subcutaneously, replacing the normal tissues. A constant process of macromelanophore elimination through the corium and epidermis takes place but the rate of 'pigment cell' accumulation is greater than pigment cell elimination. Evidence has been found pointing to the nature and origin of the macromelanophores, the 'spindle cells' of certain overgrowths and the probable relation of these elements to metabolism.

182. THE BIOTIC CONSTANTS OF *TRIBOLIUM CONFUSUM* DUVAL. Royal N. Chapman and Lillian Baird, University of Hawaii.

The length of time required for the various stages of the flour beetle, *Tribolium confusum* Duval has been determined under controlled conditions of temperature and humidity. Populations of 100 were run in duplicate and the resulting coefficients of variability are 1.95 per cent of the mean time for eggs to hatch, 2.5 per cent for the larval period and 9.3 per cent for the pupal period. The rate of oviposition was determined on the basis of 100 single pairs of beetles at each temperature. The mean number of eggs produced by a given female over a period of days shows a coefficient of variability equal to 62 per cent of the mean number of eggs. When the oviposition of a population of 100 separate females was combined and measured as the number of eggs produced per day by the population, the coefficient of variability was reduced to about 12 per cent of the mean.

The data on oviposition of single pairs do not agree with those of Park and others who did not take precautions against the eating of eggs.

183. EVOLUTIONARY TRENDS IN THE LARGE-WINGED MITES. Arthur Paul Jacot, Cornell University. (Introduced by Secretary of Section F.)

Evolutionary trends may be grouped under three heads: developments, reductions, movements (changes in position). Of movements two kinds may be recognized: definitive (trending in a definite direction), and indefinite or circumscribed. Several examples of each of these changes are to be found in the evolution of the genera of Galumninae. Changes that are definitive are usually synchronous and harmonic to the whole organism. Dis-synchronous changes occur (probably due to the independence of genes) but do not give rise to species if not harmonic to the whole organism.

184. THE FOOD OF *RANA CATESBEIANA*. S. W. Frost, Pennsylvania State College. (Introduced by A. H. Wright.)

No abstract received.

AUTHOR INDEX

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